

easyRAID Generic Software Manual (U320 SCSI / 4GFC / SAS Host Interface)

U320 SCSI Channel to Serial-ATA II

4G Fibre Channel to Serial-ATA II

4G Fibre Channel to Serial-Attached-SCSI

Serial-Attached-SCSI to Serial-Attached-SCSI

Disk Array System

Version 1.2

U320 SCSI Channel to Serial-ATAII

4G Fibre Channel to Serial-ATAII

4G Fibre Channel to Serial-Attached-SCSI

Serial-Attached-SCSI to Serial-Attached-SCSI

Disk Array System

easyRAID Generic Software Manual

Notice

Product features and specifications described in this manual are subject to change without notice.

The manufacturer shall not be liable for any damage or loss of information resulting from the performance or use of the information contained herein.

This manual has been checked for accuracy, but no guarantee is given that the contents are correct. Information and specifications can change without notice. The manufacturer is not responsible for data loss or other consequences caused by the use of this manual.

Copyright

© Copyright 2007

All rights reserved. This manual is protected by copyright and is distributed under a license restricting its use, copying, and distribution. No part of this documentation may be reproduced in any form by any means without prior written authorization and its licensors, if any.

About this manual

Congratulations on your purchase of the product. This controller allows you to control your RAID system through a user-friendly GUI, which is accessed through your web browser.

This manual is designed and written for users installing and using the RAID controller. The user should have a good working knowledge of RAID planning and data storage.

Symbols used in this manual

This manual highlights important information with the following icons:



Caution

This icon indicates the existence of a potential hazard that could result in personal injury, damage to your equipment or loss of data if the safety instruction is not observed.



Note

This icon indicates useful tips on getting the most from your RAID controller.

Table of Contents

Chapter 1: Introduction

1.1 Key Features	1-2
1.2 RAID Structure	1-3
1.3 Definitions	1-4

How to Configure Your RAID System

Chapter 2: Using the RAID GUI

2.1 Accessing the RAID GUI	2-3
2.1.1 Browser Language Setting	2-4
2.1.2 Multiple System Viewer	2-4
2.2 Monitor Mode	2-7
2.2.1 HDD state	2-8
2.2.2 Information icons	2-9
2.2.3 Rear side of the RAID system	2-11
2.2.4 Login	2-13
2.3 SAS Enclosure Display (for SAS expansion controller only)	2-14
2.3.1 Information icons	2-16
2.3.2 SAS/SATA HDD information	2-16
2.4 Config Mode	2-17
2.5 Quick Setup	2-18
2.5.1 Performance profile	2-18
2.5.2 RAID setup	2-19
2.6 RAID Management	2-20
2.6.1 Hard disks	2-20
2.6.2 JBOD	2-22
2.6.3 Disk groups	2-24
2.6.4 Logical disks	2-28
2.6.5 Volumes	2-32
2.6.6 Storage provisioning	2-35
2.7 Maintenance Utilities	2-42
2.7.1 Expanding disk groups	2-42
2.7.2 Defragmenting disk groups	2-43
2.7.3 Changing RAID level / stripe size for logical disks	2-44
2.7.4 Expanding the capacity of logical disks in a disk group	2-46

Contents

2.7.5 Shrinking logical disks	2-47
2.7.6 Expanding volumes	2-48
2.7.7 Shrinking volumes	2-49
2.7.8 Cloning hard disks	2-49
2.7.9 Scrubbing	2-51
2.7.10 Regenerating the parity	2-52
2.7.11 Performing disk self test	2-53
2.7.12 Array roaming	2-54
2.7.13 Array recovery	2-55
2.7.14 Schedule task	2-58
2.7.15 Miscellaneous	2-58
2.8 Hardware Configurations	2-60
2.8.1 Hard disks	2-60
2.8.2 FC ports	2-63
2.8.3 COM port	2-64
2.9 Event Management	2-65
2.9.1 Setting up the SMTP	2-65
2.9.2 Setting up the SNMP	2-66
2.9.3 Event logs	2-68
2.9.4 Miscellaneous	2-70
2.10 System Management	2-71
2.10.1 Restoring to factory settings	2-71
2.10.2 NVRAM configuration	2-71
2.10.3 Setting up the network	2-73
2.10.4 Setting up the time	2-74
2.10.5 Security control	2-75
2.10.6 System information	2-76
2.10.7 Battery backup module	2-76
2.10.8 Update the firmware and boot code	2-77
2.10.9 Restart or halt the controller	2-77
2.10.10 Miscellaneous	2-78
2.11 Performance Management	2-79
2.11.1 Hard disks	2-79
2.11.2 Cache	2-80
2.11.3 LUN	2-81
2.11.4 Storage port	2-83

Chapter 3: Using the LCD Console

3.1 Starting LCD Manipulation	3-1
3.1.1 Confirm password	3-2
3.2 LCD Messages	3-3
3.2.1 LCD layout	3-3
3.2.2 Status info	3-4
3.2.3 Emergent info	3-6
3.2.4 Background task messages	3-7
3.2.5 Hotkeys	3-8
3.3 Menu	3-9
3.3.1 Menu Tree	3-9
3.3.2 Creating an Array	3-10
3.3.3 Network Settings	3-10
3.3.4 Terminal Port Settings	3-11
3.3.5 System Settings	3-12
3.3.6 System Information	3-13

Chapter 4: Using the CLI Commands

4.1 Overview	4-1
4.1.1 Conventions Overview	4-1
4.2 Basic RAID Management	4-2
4.2.1 Hard disks	4-2
4.2.2 JBOD disks	4-3
4.2.3 Disk groups	4-4
4.2.4 Spare and rebuild	4-5
4.2.5 Logical disks	4-6
4.2.6 RAID algorithms options	4-7
4.2.7 Volumes	4-8
4.2.8 Cache	4-9
4.3 RAID Maintenance Utilities	4-11
4.3.1 RAID attributes reconfiguration utilities	4-11
4.3.2 Data integrity maintenance utilities	4-13
4.3.3 Task priority control	4-14
4.3.4 Task schedule management	4-15
4.3.5 On-going task monitoring	4-15
4.3.6 Array and volume roaming	4-16
4.3.7 Array recovery utilities	4-17

Contents

4.4 Storage Presentation	4-18
4.4.1 Hosts	4-18
4.4.2 Host groups	4-19
4.4.3 Storage groups	4-20
4.4.4 Presentation planning	4-21
4.4.5 Selective storage presentation	4-21
4.4.6 Simple storage presentation	4-22
4.4.7 Symmetric-LUN storage presentation	4-23
4.5 Hardware Configurations and Utilities	4-24
4.5.1 Generic hard disk	4-24
4.5.2 FC ports	4-27
4.5.3 Management network interface	4-28
4.5.4 Local terminal ports	4-30
4.5.5 Enclosure	4-30
4.6 Performance management	4-31
4.6.1 Hard disks	4-31
4.6.2 Cache	4-31
4.6.3 LUN	4-31
4.6.4 Storage ports	4-32
4.7 Event Management	4-33
4.7.1 NVRAM event logs	4-33
4.7.2 Event notification	4-34
4.7.3 Event handling	4-35
4.8 System Management	4-36
4.8.1 Configurations management	4-36
4.8.2 Time management	4-37
4.8.3 Administration security control	4-38
4.8.4 System information	4-39
4.8.5 Miscellaneous	4-40
4.9 Miscellaneous Utilities	4-41
4.9.1 Lookup RAID systems	4-41
4.9.2 Turn on/off CLI script mode	4-41
4.9.3 Get command list and usage	4-41
4.10 Configuration shortcuts	4-42
4.10.1 RAID quick setup	4-42
4.10.2 Performance profile	4-42

Chapter 5: Troubleshooting

5.1 Problems and Solutions	5-1
5.2 Beeper Alarm	5-3

Appendix A: Understanding RAID

A.1 RAID Overview	A-1
A.2 RAID 0	A-3
A.3 RAID 1	A-5
A.4 RAID 3	A-7
A.5 RAID 5	A-8
A.6 RAID 6	A-10
A.7 RAID 10	A-12
A.8 RAID 30	A-13
A.9 RAID 50	A-15
A.10 RAID 60	A-17
A.11 JBOD	A-19
A.12 NRAID	A-20

Appendix B: Boot Utility

B.1 Boot Utility Menu	B-1
B.1.1 (N) Set IP address	B-2
B.1.2 (L) Load Image by TFTP	B-3
B.1.3 (B) Update Boot ROM	B-5
B.1.4 (S) Update System ROM	B-5
B.1.5 (H) Utility menu	B-6
B.1.6 (P) Set password	B-6
B.1.7 (R) Restart system	B-6
B.1.8 (Q) Quit & Boot RAID system	B-6

Appendix C: Event Log Messages

C.1 RAID	C-1
C.2 Task	C-10
C.3 Disk	C-28
C.4 Host ports	C-39
C.5 Controller hardware	C-50
C.6 Enclosure	C-54
C.7 System	C-65
C.8 Network	C-75

List of Tables

Table 2-1	Buttons in monitor and config mode	2-6
Table 2-2	Hard disk code	2-7
Table 2-3	Hard disks tray color	2-7
Table 2-4	Information icons	2-8
Table 2-5	Components at the rear side of the system	2-10
Table 2-6	Login usernames and passwords	2-12
Table 2-7	Information icons (in SAS monitor mode)	2-14
Table 2-8	Performance profile values	2-16
Table 2-9	Hard disk information	2-18
Table 2-10	Limitations of the number of member disks	2-42
Table 2-11	State transition	2-54
Table 3-1	List of status messages	3-4
Table 3-2	List of emergent messages	3-6
Table 3-3	List of background task messages	3-7
Table 5-1	Troubleshooting	5-1

List of Figures

Figure 1-1	Layered storage objects	1-3
Figure 1-2	Local spare	1-5
Figure 1-3	Global spare	1-5
Figure 1-4	Striping member volumes	1-6
Figure 1-5	Concatenating member volumes	1-6
Figure 1-6	Concatenated striping member volumes	1-6
Figure 1-7	Disk group expansion by adding new member disks and enlarging the last free chunk	1-8
Figure 1-8	Disk group expansion by adding new member disks and creating a new free chunk	1-8
Figure 1-9	Disk group expansion to consolidate free chunks	1-9
Figure 1-10	Logical disk capacity expansion by allocating an adjacent free chunk	1-9
Figure 1-11	Logical disk capacity expansion by moving logical disks to a free chunk	1-10
Figure 1-12	Logical disk capacity expansion by allocating an adjacent free chunk and moving logical disks	1-10
Figure 1-13	Logical disk capacity shrink and expanding an adjacent free chunk	1-11
Figure 1-14	Logical disk capacity shrink and creating a new free chunk	1-11
Figure 1-15	Defragment a disk group to expand the last free chunk	1-12
Figure 1-16	Defragment a disk group to consolidate free chunks	1-12
Figure 2-1	GUI login screen	2-3
Figure 2-1-1	GUI login screen (4U24Bay)	2-3
Figure 2-2	Multiple system viewer (side button)	2-4
Figure 2-2-1	Multiple system viewer (side button)(4U24Bay)	2-5
Figure 2-3	Opening the multiple system viewer	2-5
Figure 2-3-1	Opening the multiple system viewer (4U24Bay)	2-5
Figure 2-4	GUI monitor mode	2-7
Figure 2-5	HDD Tray (GUI)	2-8
Figure 2-6	Rear side of the RAID system (GUI)	2-11
Figure 2-6-1	Rear side of the RAID system (GUI) (4U24Bay)	2-11

Contents

Figure 2-7	Login section	2-13
Figure 2-8	SAS enclosure monitor mode	2-14
Figure 2-9	SAS enclosure configuration mode	2-15
Figure 2-10	Overview screen	2-17
Figure 2-11	Method switching message	2-35
Figure 2-12	Simple storage	2-35
Figure 2-13	Symmetric storage	2-37
Figure 2-14	Selective storage	2-39
Figure 2-15	Specify the percentage for Bad Block Alert	2-61
Figure 2-16	Specify the percentage for Bad Block Clone	2-61
Figure 2-17	Event log download message	2-68
Figure 2-18	Options in the Configurations screen-1 (System Management menu)	2-71
Figure 2-19	Options in the Configurations screen-2 (System Management menu)	2-72
Figure 2-20	Options in the Configurations screen-3 (System Management menu)	2-72
Figure 2-21	Options in the Configurations screen-4 (System Management menu)	2-73
Figure 2-22	Hard Disks screen (Performance Management menu)	2-79
Figure 2-23	Cache screen (Performance Management menu)	2-80
Figure 2-24	LUN screen (Performance Management menu)	2-81
Figure 2-25	Storage Port screen (Performance Management menu)	2-83
Figure 3-1	LCD manipulation procedure	3-1
Figure 3-2	Menu tree	3-9
Figure A-1	RAID 0 disk array	A-4
Figure A-2	RAID 1 disk array	A-6
Figure A-3	RAID 3 disk array	A-7
Figure A-4	RAID 5 disk array	A-9
Figure A-5	RAID 6 disk array	A-11
Figure A-6	RAID 10 disk array	A-12
Figure A-7	RAID 30 disk array	A-14
Figure A-8	RAID 50 disk array	A-16
Figure A-9	RAID 60 disk array	A-18

Figure A-10 JBOD disk array	A-19
Figure A-11 RAID	A-20

Chapter 1: Introduction

Congratulations on your purchase of our RAID (Redundant Array of Independent/Inexpensive Disks) system. This RAID system is a high-performance and extremely flexible RAID device.

The product is a high-performance RAID system. It features delayed-write/pre-read algorithms for improved host access and is the ultimate flexible RAID solution. It provides ten RAID levels (RAID 0, 1, 3, 5, 6, 10, 30, 50, 60 and NRAID) and a single-disk JBOD configuration. RAID 30/50/60 are supported by data striping volumes over logical disks.

The RAID system offers a wide range of choices and complete security. Although several disk drives can be used, the system will recognize an array within the system as one logical disk and treat it as any normal system disk. The capacity of this drive depends on the number of disks used and the RAID level of the array group. All RAID and online hot plug / hot spare functions are transparent to the operating system.

Featuring intelligent online recovery, the RAID system lets you hot swap a failed drive. Data will automatically be rebuilt to a new drive without any system down-time. If one drive fails, data is secured by other drives and an alarm will sound.

1.1 Key Features

- Supports RAID level 0, 1, 3, 5, 6, 10, 30, 50, 60, NRAID and JBOD
- Supports up to 8 disk groups, 32 logical disks per disk group, 32 volumes, 8 logical disks per volume
- Supports three storage provision methods: simple, symmetric, and selective
- Supports SAS hard disks (for SAS controller solution)
- Supports SAS expansion enclosures (for SAS expansion controller solution)
- Supports SCSI-3 Persistent Reservations for clustering hosts
- Supports Telnet and SSH (Secure Shell)
- Supports SSL (HTTPS) forced encryption
- Supports multiple RAID system viewer on GUI
- Variable stripe sizes support: 4KB, 8KB, 16KB, 32KB, 64KB, 128KB, 256KB, 512KB
- Supports independently-selectable strip size for each logical disk
- Supports independently-selectable RAID level for each logical disk
- Supports battery backup function (optional)
- Supports cache memory size up to 4GB in DDRII-667 DIMM type with/without ECC embedded
- Supports I2C interface
- Supports global/local hot spare disk
- Automatic drive failure detection
- Automatic drive rebuild
- Supports array roaming
- Supports online RAID level migration
- Supports online stripe size migration
- Supports online background initialization
- Supports online LUN capacity expansion and shrink
- Supports online disk group expansion
- Supports online disk group defragmentation

- Supports online volume capacity concatenation expansion and shrink
- Supports disk scrubbing, SMART, and clone
- Supports host channel auto-negotiate function
- Supports multiple languages
- Dual flash memory support for system code
- Compatible with Microsoft Storage Server 2003

1.2 RAID Structure

The services in the controller are provided by storage objects, which are hierarchically organized into layers. The hard disks are the only physical storage objects. The other storage objects, JBOD disks, logical disks, and volumes, are virtual disks. Virtual disks are created by the controller, and the configuration and management tasks are performed on these disks.

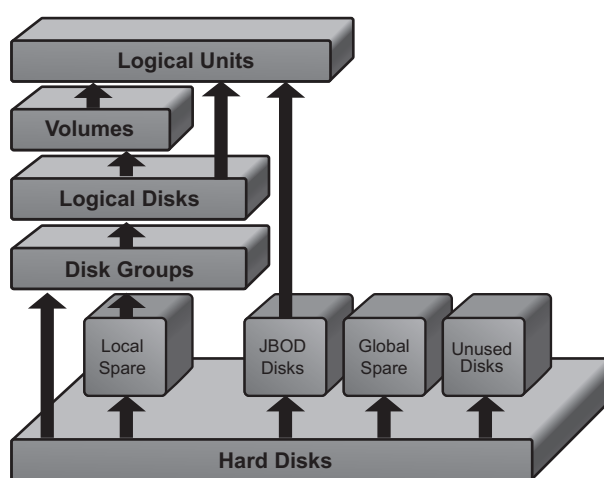


Figure 1-1 Layered storage objects

1.3 Definitions

Understanding the following definitions will help you when operating the RAID GUI.

- **Member disk**

The hard disks in a disk group are member disks (MD). A member disk of a disk group can be a data disk or a local spare disk. A data member disk provides storage space to form logical disks in a disk group.

- **Disk group**

A disk group (DG) is a group of hard disks, on which logical disks can be created. Operations to a disk group are applied to hard disks in the disk group.

- **Logical disk**

A logical disk (LD) is formed by partitioning the space of a disk group. Logical disks always use contiguous space, and the space of a logical disk is evenly distributed across all member disks of the disk group. A logical disk can be exported to hosts as a LUN.

- **Logical unit**

A logical unit (LUN) is a logical entity within a SCSI target that receives and executes I/O commands from SCSI initiators (hosts). SCSI I/O commands are sent to a target device and executed by a LUN within the target.

- **Local spare**

Local spare allows for the automatic replacement of a failed disk without intervention from the administrator. When a disk fails, the controller will automatically replace the faulty disk with the configured local spare disk. When the controller detects a failed disk, it is automatically replaced with the local spare. The array will be reconfigured and rebuilt in the background, while the operating system on the host continues to run normally.

In the example to the right, HDD4 is the local spare disk dedicated to a disk group (DG0). When a member disk (HDD1) of a disk group fails, the local spare disk joins the disk group and starts to rebuild the data. If there are multiple local spare disks, the disk with the lowest hard disk ID will be used.

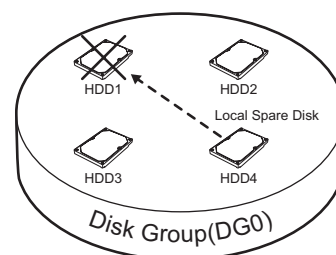


Figure 1-2 Local spare

- **Global spare**

Global spare allows for the removal and installation of disk drives without interrupting data access while the controller is in use. This is usually performed when there is no local spare disk configured. The global spare disk serves more than one specified disk group. When a member disk of any disk group fails and there is no local spare disk, the global spare disk joins that disk group. RAID rebuilding will be processed automatically in the background, and the progress will be monitored.

In the example below, the global spare disk (HDD5) will replace any member disk of a disk group when a disk fails. If there are multiple global spare disks, the disk with the lowest hard disk ID will be used.

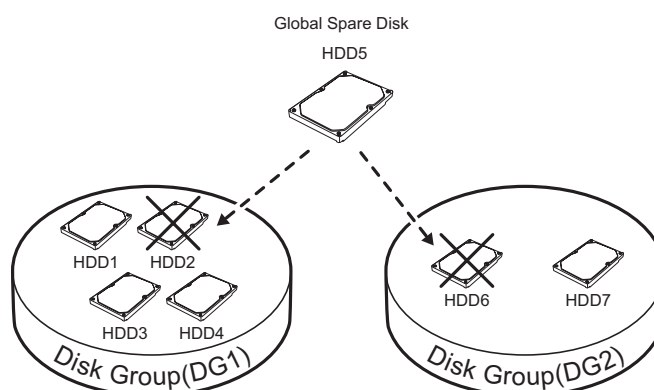


Figure 1-3 Global spare

- **Free chunk**

A free chunk is a contiguous block of space in a disk group which is not occupied by any logical disks. When a disk group is created and there is no logical disk in the disk group, all space in the disk group forms a free chunk.

- **Volume**

A volume is composed of LDs over which the data stripes. For example, RAID 30/50/60 are supported by data striping volumes over logical disks [the logical disks in a volume are the member volumes (MV) of a volume]. Each volume unit is made up of one member volume or a set of striped member volumes. With volume units, a volume can be a group of striping member volumes, concatenated member volumes, or concatenated striping member volumes. The following figures show examples of these three volume constructions.

Striping: A volume formed by single volume unit.

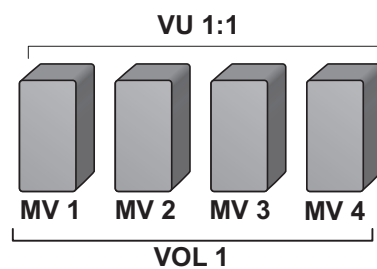


Figure 1-4 Striping member volumes

Concatenating: A volume formed by multiple volume units.

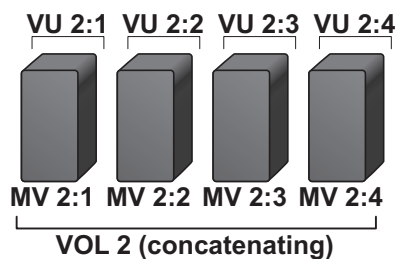


Figure 1-5 Concatenating member volumes

Concatenated striping: A volume formed by concatenating set of striping member volumes.

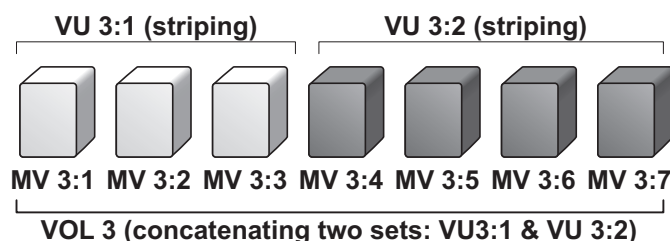


Figure 1-6 Concatenated striping member volumes

- **LUN mapping**

A LUN mapping is a set of mapping relationships between LUNs and virtual disks in the controller. Computer systems can access the LUNs presented by the controller after inquiring host ports of the controller.

- **Delayed Write Operation**

The RAID subsystem of this controller provides a Delayed Write mechanism to manage ongoing write operations from the host. The controller returns acknowledgement to the host right after the data comes into the write-buffer, while the content of the write-buffer will be flushed into the disk group sometime later. The write performance is enhanced by this mechanism.

- **SSL**

Secure Sockets Layer (SSL) is a data transmission protocol that ensures the security of any data transmitted over the Internet. SSL uses a program layer located between the Internet's Hypertext Transfer Protocol (HTTP) and Transport Control Protocol (TCP) layers. URLs that require an SSL connection start with https: instead of http:.

- **Pre-Read Operation**

The controller reads the data from a logical disk in advance once a sequential read stream is detected.

- **Tagged Queuing**

Featuring a SCSI tagged queuing mechanism, the controller can accept up to 512 commands currently outstanding from the host. This improves the overall performance as a result of a pipelining effect.

- **Disk group expansion**

Disk group expansion can be used to increase space by adding one or more disks to the disk group. When the expansion task is complete, the new space is created in the end space of the disk group. Logical disks can be created in the space set up by the expansion.

**Note**

The sectors of the new space are not initialized. Selecting **no initialization** when creating logical disks on the new space is not advised.

Disk group expansion to expand the last existing free chunk

If the disk group has free chunks in the end space, the capacity of the free chunk will be increased after the expansion. The capacity of existing logical disks will not be affected.

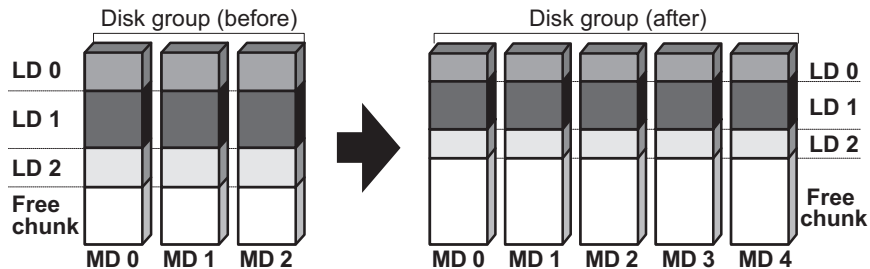


Figure 1-7 Disk group expansion by adding new member disks and enlarging the last free chunk

Disk group expansion to create a free chunk

If the disk group has no free chunks in the end space before expansion, a new free chunk will be created.

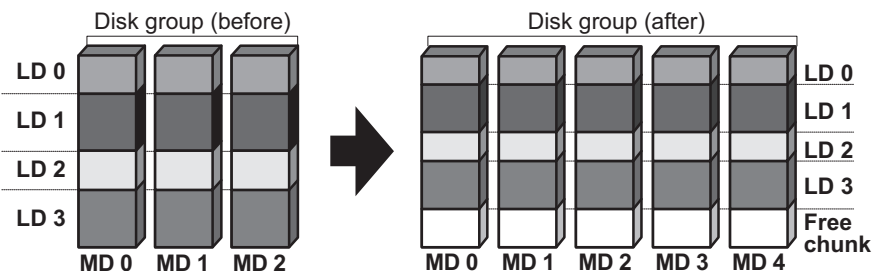


Figure 1-8 Disk group expansion by adding new member disks and creating a new free chunk

Disk group expansion to consolidate free chunks

When disk group expansion is executed in a disk group where free chunks between logical disks exist, the free chunks are consolidated and placed in the end space of the disk group after expansion.

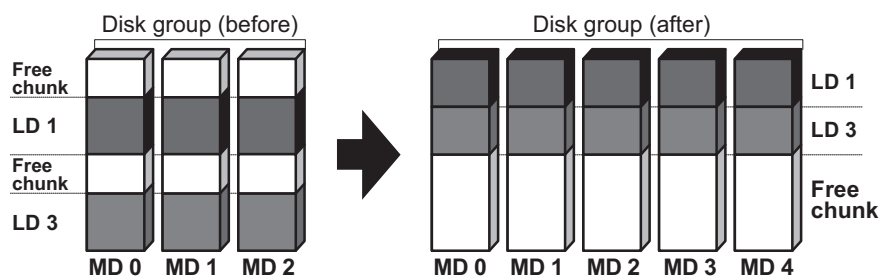


Figure 1-9 Disk group expansion to consolidate free chunks



Note

It is suggested that defragmentation should be performed during disk group expansion. In the cases shown in Figures 1-5, 1-6, and 1-7, defragmentation forms an organized collocation for all logical disks and free chunks after expansion.

- **Logical disk expansion**

Logical disk expansion can be used to increase the capacity of a logical disk by allocating free chunks and by moving logical disks in the same disk group to consolidate a free chunk for the new space of the selected logical disks.

Expand a logical disk by allocating an adjacent free chunk

If there is a free chunk right after the logical disk, the required capacity of the logical disk can be allocated immediately via the free chunk.

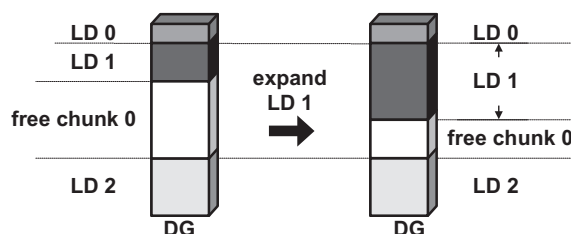


Figure 1-10 Logical disk capacity expansion by allocating an adjacent free chunk

Expand a logical disk by moving logical disks to a free chunk

If there is no free chunk right after the selected logical disk, the controller will start a background task to move nearby logical disks to fill the requested capacity.

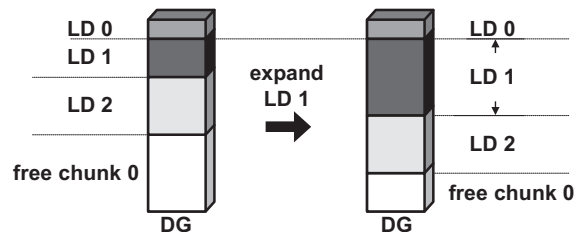


Figure 1-11 Logical disk capacity expansion by moving logical disks to a free chunk

Expand a logical disk by allocating an adjacent free chunk and moving logical disks

If the free chunk right after the selected logical disk is not sufficient for expansion, the controller will allocate the free chunk and also start a background task to move logical disks.

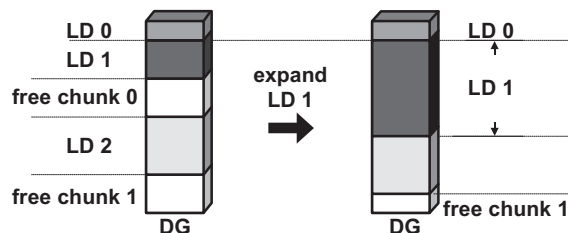


Figure 1-12 Logical disk capacity expansion by allocating an adjacent free chunk and moving logical disks

- **Logical disk shrink**

Logical disk shrink can be used to decrease the capacity of a logical disk. It is advised that the file systems on the host be shrunk before shrinking the logical disks.

Shrink logical disk with an adjacent free chunk

When a logical disk is shrunk, the free chunk right after the logical disk is expanded.

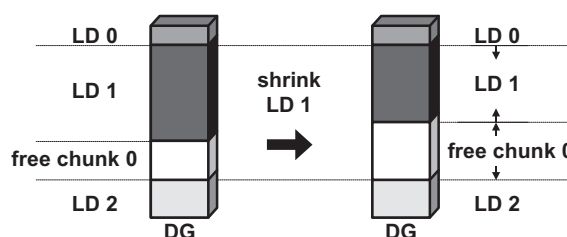


Figure 1-13 Logical disk capacity shrink and expanding an adjacent free chunk

Shrink a logical disk without an adjacent free chunk

After a logical disk is shrunk, a free chunk is created next to the logical disk.

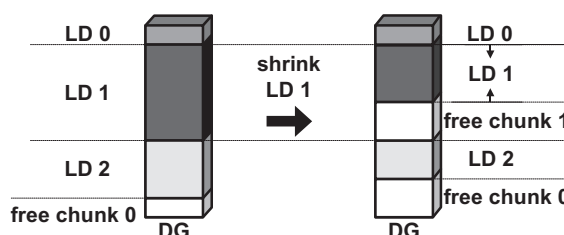


Figure 1-14 Logical disk capacity shrink and creating a new free chunk

When performing logical disk shrink, the capacity of the corresponding LUNs will be modified immediately and any attempt to access to the space beyond the new capacity will be rejected. Please note this may lead to data loss.

- **Disk group defragmentation**

When a logical disk is deleted, the partitions of each member disk occupied by the logical disk may become free chunks. If none of the free chunks have space available for a new logical disk, use defragmentation to consolidate all free chunks into one.

Defragment a disk group to expand the last free chunk

All existing free chunks except the one at the end of the disk group are deleted, and the last free chunk is expanded.

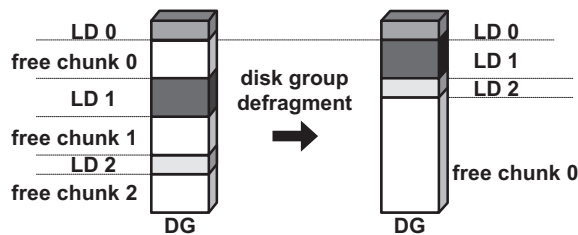


Figure 1-15 Defragment a disk group to expand the last free chunk

Defragment a disk group to consolidate free chunks

All existing free chunks are deleted, and a single free chunk at the end of the disk group is created.

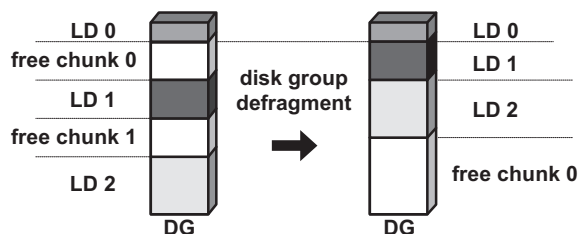


Figure 1-16 Defragment a disk group to consolidate free chunks

How to Configure Your RAID System

There are three ways to configure your RAID system. Each of them uses different interface. For detailed instructions on each of them, see the following chapters:

Chapter 2 Using the RAID GUI

The RAID GUI console uses an Ethernet connection through a LAN port. In this console, you can scroll through menus and submenus to locate and select the desired configuration option.

Chapter 3 Using the LCD console

The LCD control panel buttons on the RAID system provide an easy way to quickly setup your RAID system.

Chapter 4 Using the CLI commands

The CLI console uses a terminal connection with the controller's serial port. In this console, you can enter commands for RAID configuration.

Chapter 2: Using the RAID GUI

2.1 Accessing the RAID GUI

1. Open a browser and enter the IP address in the address field. (The default IP address is 192.168.0.1.

The supported browsers are listed as below:

- IE 6.x (Windows)
 - FireFox 1.x (Windows, Linux, and Mac)
 - Safari 1.x and 2.x (Mac)
2. The following webpage appears when the connection is made. To login, enter the username and password (see **2.2.4 Login**). You can then access the Config Mode.



Figure 2-1 GUI login screen



Figure 2-1-1 GUI login screen (4U 24Bay)

2.1.1 Browser Language Setting

The GUI is currently available in English, Traditional Chinese, and Simplified Chinese. (The following example shows how to set up language in Internet Explorer 6. Other browsers support the same functionality. Please refer to the instructions included with your browser and configure the language accordingly.)

Open your web browser and follow the steps below to change the GUI language.

1. Click **Tools > Internet Options > Language > Add**.
2. In the **Add Language** window, find the language you want to use, and click **OK**.
3. In the **Language Preference** window, select the language you want to use, and use the **Move Up** and **Move Down** buttons to move it up to the top of the list. Click **OK**.
4. Click **OK** again to confirm the settings.



Note

If the GUI does not support the selected language, the webpage will still appear in English.

2.1.2 Multiple System Viewer

The RAID GUI features a side button for a quick on-line system view. The side button is always on the left side of the screen so that you can click to view all the other on-line systems at anytime. Move the cursor over the side button and the multiple system viewer appears (see **Figure 2-3**).



Figure 2-2 Multiple system viewer (side button)



Figure 2-2-1 Multiple system viewer (side button)(4U24Bay)



Figure 2-3 Opening the multiple system viewer



Figure 2-3-1 Opening the multiple system viewer(4U24Bay)

Using the RAID GUI

Move the cursor to a system, and the following system information will appear: IP address, System name, Model name, F/W version, and Status. Click on a system to open its GUI, and you can login to view the complete system information.

If there are too many on-line systems displayed in the viewer at one time, you can use the arrow buttons to scroll up and down. Click the  button to refresh the viewer.

Move your cursor away from the viewer, and it disappears.



Note

1. The multiple system viewer supports up to 256 on-line systems.
2. Only systems in the same subnet mask will appear in the multiple system viewer.

2.2 Monitor Mode

RAID GUI monitors the status of your RAID controller(s) through your Ethernet connection. The RAID GUI window first displays the Monitor Mode. This mode is also the login to enter Config Mode. The GUI components shown are introduced in the following sections.



Figure 2-4 GUI monitor mode

There are four buttons at the top right of the page. See the following table for each button's function.

Table 2-1 Buttons in monitor and config mode

Button	Description
 Switch Mode	Switches between Monitor Mode and Config Mode.
 Logout	Logs out the user.
 Help	Opens the Help file.
 About	Displays the GUI version, firmware version, and boot code version.

System name, controller name, firmware version, and boot code version information are also displayed at the bottom left of the page.

2.2.1 HDD state

Through the front panel of the RAID console displayed in the GUI, you can easily identify the status of each hard disk by its color and status code. Click on each hard disk to display detailed information.

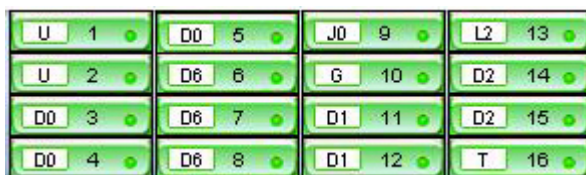


Figure 2-5 HDD Tray (GUI)



Note

The HDD state depends on respective RAID system. Please refer to Hardware User Manual.

The status code and color of hard disks are explained in the following tables.

Table 2-2 Hard disk code

Code	Hard Disk Status
U	Unused disk
J0-J15	JBOD
D0-D7	Disk group
L0-L7	Local spare
G	Global spare
T	Clone

Table 2-3 Hard disks tray color

Color	Hard Disk Status
 Green	Online Adding (flashing green)
 Red	Faulty
 Orange	Conflict
 Blue	Foreign
 Silver	Permanently removed
 Gray	Removed
	Empty

2.2.2 Information icons

When components are working normally, their icons are shown in green. When components fail to work, the icons are shown in red. Click on each icon for detailed information..

Table 2-4 Information icons

Icon	Name	Detailed Information
	Event log view	• Seq. No. • Severity • Type • Time • Description
	Beeper	See 5.2 Beeper Alarm for the possible beeper reasons.
	Temperature	• Sensor • Current • Non-critical* • Critical*
	Voltage	• Sensor • Current • High Limit* • Low Limit*
	Fan module (This icon will be shown when the fan is installed on the controller.)	• Controller Fan
	BBM (This icon will be shown when the BBM control is on.)	• State • Serial Number • Device Chemistry • Remaining Capacity • Remaining Time to Full (minute) • Voltage (V) • Current (A) • Temperature (°C/°F) • Non-critical Temperature (°C/°F)* • Critical Temperature (°C/°F)*

Table 2-4 Information icons

	UPS (This icon will be shown when the UPS control is on.)	UPS Status • State • Load Percentage • Temperature (°C/°F) • AC Input Quality/ High Voltage (V)/ Low Voltage (V) Battery Status • State • Voltage (V) • Remaining Power in percentage/ seconds
---	---	--

2.2.3 Rear side of the RAID system

On the rear side of the RAID system, you can see the two fan modules, two power supplies, two fiber ports, and one Ethernet port. Click on the components for detailed information.

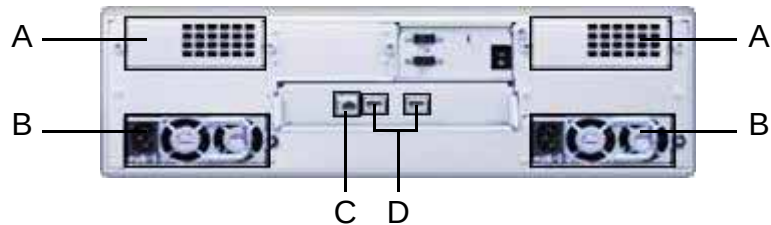


Figure 2-6 Rear side of the RAID system (GUI)

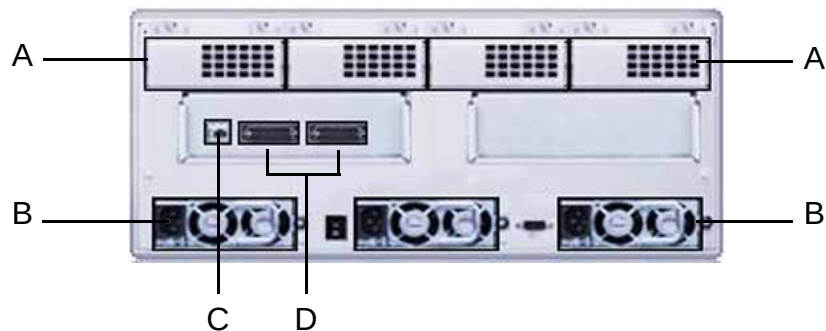


Figure 2-6-1 Rear side of the RAID system (GUI)(4U24Bay)



Note

The rear side presentation depends on respective RAID system. Please refer to Hardware User Manual.

Table 2-5 Components at the rear side of the system

	Component	Detailed Information
A	Fan module	• BP_FAN1 • BP_FAN2 • BP_FAN3 • BP_FAN4
B	Power supply	• POW1 • POW2

Table 2-5 Components at the rear side of the system

C	Ethernet port	• IP Address • Network Mask • Gateway • DNS Server • MAC Address
	Fiber ports	• FCP ID • WWN • Connection Mode • Data Rate • Hard Loop ID
	SCSI ports(F.2-6-1)	• Connection Mode • Data Rate

2.2.4 Login



Figure 2-7 Login section

The RAID GUI provides two sets of default login members.

Table 2-6 Login usernames and passwords

Username	user	admin
Password	0000	0000

When logging in to the GUI as **user**, you can only view the settings. To modify the settings, use **admin** to log in.

- **Forgotten password**

In the event that you forget your password, click the **Forget password** icon and an email containing your password can be sent to a preset mail account. To enable this function, make sure the Password Reminding Mail option is set to On (see **2.10.5 Security control**), and the mail server has been configured in **System Management > Network**.

2.3 SAS Enclosure Display (for SAS expansion controller only)

The RAID subsystem provides a SAS expansion port which allows users to connect a SAS JBOD. A maximum of three enclosures can be connected to the subsystem serially, and each enclosure supports up to 16 SAS hard disks. (SATA II compatible)

When SAS/SATA hard disks are connected, the enclosure tabs will appear in the Monitor Mode (see **Figure 2-8** shown below). Each tab view displays different information for each connected enclosure. Click the **Enclosure 0** tab to view the information of the local RAID subsystem. Click the **Enclosure 1**, **Enclosure 2**, or **Enclosure 3** tabs for a brief view of the connected SAS JBOD.

Enclosure tabs

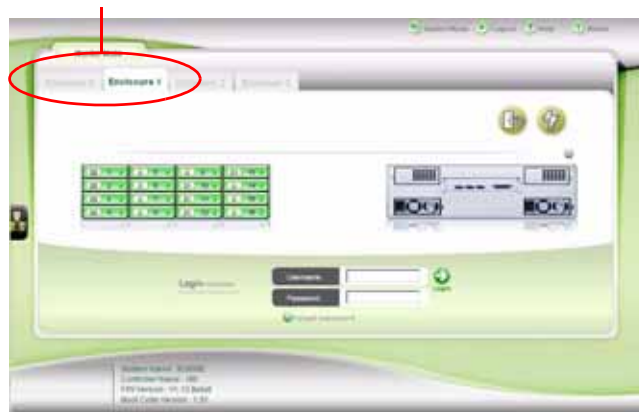


Figure 2-8 SAS enclosure monitor mode

Figure 2-9 displays the Config Mode when a SAS enclosure is connected. Use the drop-down menu at the top of the page to select the enclosure ID you wish to configure.

Enclosure ID drop-down menu

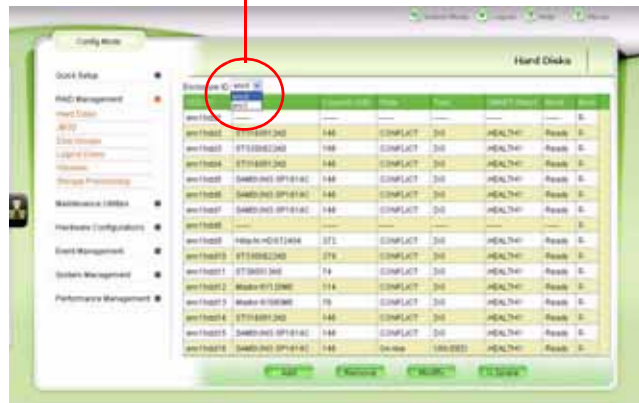


Figure 2-9 SAS enclosure configuration mode



Note

In order to use the expansion port on the SAS controller, you must have firmware version 1.20 or later for complete functionality.

2.3.1 Information icons

In Monitor Mode, the following information icons are displayed on the screen. When components are working normally, their icons are shown in green. When components fail to work, the icons are shown in red. Click on each icon for detailed information.

Table 2-7 Information icons (in SAS monitor mode)

Icon	Name	Detailed Information
	Temperature	• Sensor • Current • Non-critical • Critical
	Voltage	• Sensor • Current • High Limit • Low Limit
	Fan module	• BP_FAN1 • BP_FAN2 • BP_FAN3 • BP_FAN4
	Power supply	• POW1 • POW2

2.3.2 SAS/SATA HDD information

Through the hard disk codes and tray color shown on the screen, you can easily identify the status of each connected SAS/SATA hard disk. Click on each SAS/SATA hard disk to display detailed information.

For more information about hard disk codes and tray colors, see **Table 2-2** and **Table 2-3**.

2.4 Config Mode

To configure any settings under Config Mode, log in with **admin** and its password. The **Overview** screen displays as below.

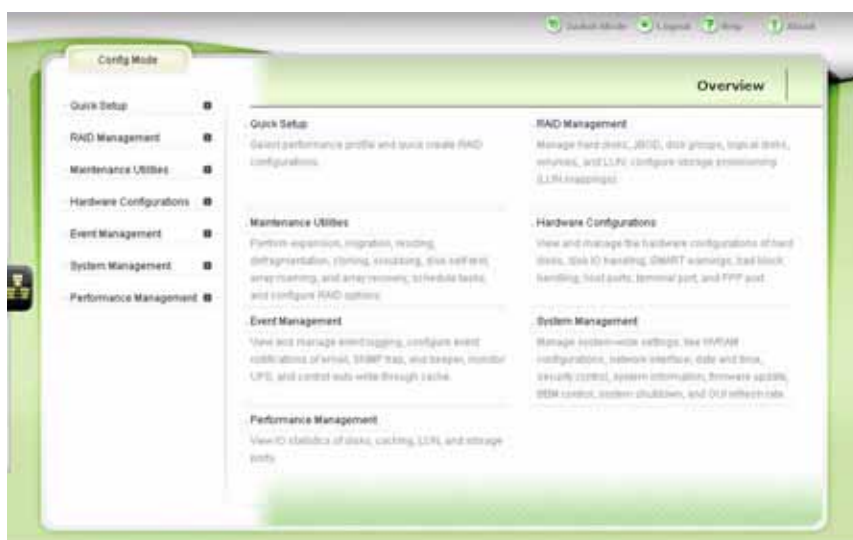


Figure 2-10 Overview screen

The RAID GUI Config Mode provides the following configuration settings.

Quick Setup	Allows you to configure your array quickly.
RAID Management	Allows you to plan your array.
Maintenance Utilities	Allows you to perform maintenance tasks on your arrays.
Hardware Configurations	Allows you to configure the settings to hard disks, FC ports, and COM port settings.
Event Management	Allows you to configure event mail and event logs.
System Management	Allows you to erase or restore the NVRAM configurations, set up the mail server, update the firmware and boot code and so on.
Performance Management	Allows you to check the IO statistics of hard disks, caches, LUNs, and FC ports.

Before configuration, read “Understanding RAID” thoroughly for RAID management operations.

2.5 Quick Setup

2.5.1 Performance profile

The RAID GUI provides three performance profiles for you to apply the preset settings to the RAID configuration. This allows users to achieve the optimal performance for a specified application. When using a profile for the RAID configuration, any attempt to change the settings is rejected. See the following table for the values of each profile. Select **Off** if you want to configure the settings manually.

Table 2-8 Performance profile values

Profile	AV streaming	Maximum IO per second	Maximum throughput
Disk IO Retry Count	0	1	1
Disk IO Timeout (second)	3	30	30
Bad Block Retry	Off	On	On
Bad Block Alert	On	N/A	N/A
Disk Cache	On	On	On
Write Cache	On	On	On
Write Cache Periodic Flush (second)	5	5	5
Write Cache Flush Ratio (%)	45	45	45
Read Ahead Policy	Adaptive	Off	Adaptive
Read Ahead Multiplier	8	-	16
Read Logs	32	-	32

2.5.2 RAID setup

To perform quick setup, all hard disks must be on-line and unused. Users can specify the RAID level, number of spare disks, and initiation method for an easy RAID configuration. See the following for details of each option.

HDD Information	This shows the number and the minimum size of hard disks.
RAID Level	RAID 0 / RAID 3 / RAID 5 / RAID 6 / RAID 10 / RAID 30 / RAID 50 / RAID 60
Spare Disks	Select the required number of global spare disks.
Initialization Option	Background: The controller starts a background task to initialize the logical disk by synchronizing the data stored on the member disks of the logical disk. This option is only available for logical disks with parity-based and mirroring-based RAID levels. The logical disk can be accessed immediately after it is created. Noinit: No initialization process, and the logical disk can be accessed immediately after it is created. There is no fault-tolerance capability even for parity-based RAID levels. Regular: The controller initializes the logical disk by writing zeros to all sectors on all member disks of the logical disk. This ensures that all data in the logical disks is scanned and erased.

2.6 RAID Management

2.6.1 Hard disks

This feature allows you to add or remove hard disks and set any online disk as global spare drive. The hard disk information included is listed as follows.

Table 2-9 Hard disk information

Category	Display
HDD ID	Hard disk identifier
Model	Hard disk model name
Capacity (GB)	Hard disk capacity
State	On-line, Foreign, Conflict, Removed, PRemoved, Faulty, Initializing, Unknown.
Type	Unused, JBOD disk, DG data disk, Local spare, Global spare, or Clone target
SMART Status	Healthy, Alert, or Not supported
Mode	Ready, Standby, or Unknown

- **State definition**

On-line: The hard disk remains online when it is working properly.

Foreign: The hard disk is moved from another controller.

Conflict: The hard disk may have configurations that conflict with controller configurations.

Removed: The hard disk is removed.

PRemoved: The hard disk is permanently removed.

Faulty: The hard disk becomes faulty when a failure occurs.

Initializing: The hard disk starts the initialization.

Unknown: The hard disk is not recognized by the controller.

- **Mode definition**

Ready: The hard disk is in use or ready for use.

Standby: The hard disk is in standby mode.

Unknown: The hard disk is not recognized by the controller.

- **Buttons**

Add: To add hard disks, select a hard disk and click this button.

Remove: To remove hard disks, select a hard disk and click this button. To remove hard disks permanently, check the **Permanent remove** box when removing them.

Modify: Select a hard disk and click this button to enter the settings screen to enable or disable the disk cache and the disk identify function.



Note

1. When the selected hard disk is not in the on-line state, the Disk Cache field will not be displayed.
2. If a hard disk belongs to a disk group, you cannot change its disk cache. To modify it, refer to **2.6.3 Disk groups**.
3. If the hard disk belongs to a disk group, you can check the '**Apply to all members of this DG**' option to apply the disk identify setting to all the member disks in a disk group.

G.Spare: To add or remove global spare disks, click this button to enter the settings screen.

- **Detailed hard disk information**

Click  to display a complete list of hard disk information. You will see the following details.

- | | |
|--------------------------|--------------------------------------|
| • HDD ID | • NCQ Supported |
| • UUID | • NCQ Status |
| • Physical Capacity (KB) | • Command Queue Depth |
| • Physical Type | • Standard Version Number |
| • Transfer Speed | • Reserved Size of Remap Bad Sectors |
| • Disk Cache Setting | • Bad Sectors Detected |
| • Disk Cache Status | • Bad Sectors Reallocated |
| • Firmware Version | • Disk Identify |
| • Serial Number | |
| • WWPN | |

2.6.2 JBOD

This feature allows you to create, delete, and modify your JBOD settings.

- **Create JBOD disks**

Click **Create** to add a new JBOD disk, where up to a maximum of 16 JBOD disks can be created. Specify the following options for the configuration.

JBOD ID	Select a JBOD ID from the drop-down menu.
Name	Use the system default name as jbdx . 'x' is the JBOD identifier. OR Uncheck the ' Use system default name ' box and enter the name in the Name field. The maximum name length is 63 bytes.
Member Disk	Select a corresponding hard disk to be used for JBOD from the drop-down menu.

- **Delete JBOD disks**

Select the JBOD disk(s) you want to delete and click **Delete**. To delete all LUNs of **jbdx**, check the '**Force to delete LUN mapping(s)**' box. All access to the JBOD will be stopped.

- **Modify JBOD disks**

To modify a setting, select a JBOD and click **Modify**. Specify the following options for configuration.

Name	Type a name for the JBOD ID.
Write Cache	This option enables or disables the write cache of a JBOD disk.
Write Sorting	This option enables or disables the sorting in the write cache. To improve writing performance, it is recommended to turn this option on for random access. This option is available only if the write cache is on.

Read Ahead Policy

Always: The controller performs pre-fetching data for every read command from hosts.

Adaptive: The controller performs pre-fetching only for host read commands that are detected as sequential reads. The detection is done by read logs.

Off: If there is no sequential read command, read-ahead will result in overhead, and you can disable the read-ahead.

Read Ahead Multiplier

This option specifies the read ahead multiplier for the **Always** and **Adaptive** read ahead policies. Select how much additional sequential data will be pre-fetched. The default value is 8.

Read Logs

This option specifies the number of read logs for the **Adaptive** read ahead policy. The range is between 1 and 128. The default value is 32.

To clear write buffers in the write cache of a JBOD disk, select a JBOD and click the **Flush** button.

- **Detailed JBOD disk information**

Click  to display a complete list of JBOD disk information. You will see the following details.

- JBOD ID
- UUID
- Created Time and Date
- Write Cache Status
- Write Cache Setting
- Write Sorting
- Read Ahead Policy
- Read Ahead Multiplier
- Read Logs

2.6.3 Disk groups

This feature allows you to create, delete, and modify your disk group settings.

- **Create disk groups**

Click **Create** to add a new disk group, where up to a maximum of 8 disk groups can be created. Specify the following options for configuration.

DG ID	Select a DG ID from the drop-down menu.
Name	Use the system default name as dgx . 'x' is the DG identifier. OR Uncheck the ' Use system default name ' box and enter the name in the Name field. The maximum name length is 63 bytes.
Members and Spares	Select member disks and spare disks to be grouped.
Capacity to Truncate (GB)	Specifies the capacity to be truncated for the smallest disk of this disk group. This option is useful when the replacement disk that is slightly smaller than the original disk. Without this option, the capacity to truncate is 0GB.
LD Initialization Mode	The initialization mode defines how logical disks of a disk group are initialized. Different disk groups can have different initialization modes. Parallel: The initialization tasks of logical disks are performed concurrently. Sequential: Only one initialization task is active at a time.
Write-zero immediately	When enabled, this function will start a background task to write zero to all member disks of the created disk group. The disk group can be used for logical disks only after this process is completed.



Note

The minimum number of member disks in a disk group is two. Different disk groups may have a different number of member disks. The number of member disks also determines the RAID level that can be used in the disk group.

- **Delete disk groups**

Select the disk group(s) you want to delete and click **Delete**.

- **Modify disk groups**

To modify a setting, select a DG and click **Modify**. Specify the following options for configuration.

Name	Type a name associated for the DG ID.
Spare Disks	Assign disks to be used as local spares.
Disk Cache	This option enables or disables the on-disk cache of hard disks in a disk group. When a new disk becomes a member of the disk group (for example, by disk rebuilding and cloning); the on-disk cache uses the same settings as the disk group.
LD Initialization Mode	The initialization mode defines how logical disks of a disk group are initialized. Different disk groups can have different initialization modes. Parallel: The initialization tasks of logical disks are performed concurrently. Sequential: Only one initialization task is active at a time.

LD Rebuild Mode	This determines how to rebuild logical disks in a disk group. All logical disks can be rebuilt at the same time or one at a time. Different disk groups can have different rebuild modes. Parallel: The rebuilding tasks are started simultaneously for all logical disks in the disk group. The progress of each rebuilding task is independent from each other. Sequential: Rebuilding always starts from the logical disk with the smallest relative LBA on the disk group, continues to the logical disk with the second smallest relative LBA, and so on. Prioritized: Similar to sequential rebuild mode, this rebuilds one logical disk at a time, but the order of logical disks to be rebuilt can be determined by users.
Rebuild Task Priority	Low / Medium / High This option sets the priority of the background task for disk rebuild of disk groups.
Initialization Task Priority	Low / Medium / High This option sets the priority of the background tasks for logical disk initialization of disk groups.
Utilities Task Priority	Low / Medium / High This option sets the priority of the background tasks for utilities of disk groups. These include RAID reconfiguration utilities and data integrity maintenance utilities.



Note

1. Progress rates increase in proportion to priority (i.e. A high priority task runs faster than a low priority one.)
2. When there is no host access, all tasks (regardless of priority) run at their fastest possible speed.
3. When host access exists, tasks run at their minimum possible speed.

- **Detailed disk group information**

Click  to display a complete list of disk group information. You will see the following details.

- DG ID
- UUID
- Created Time and Date
- Disk Cache Setting
- LD Initialization Mode
- LD Rebuild Mode
- LD Rebuild Order
- Rebuild Task Priority
- Initialization Task Priority
- Utilities Task Priority
- Member Disk's Layout
- Original Member Disks

2.6.4 Logical disks

This feature allows you to create, delete, and modify your logical disk settings.

- **Create logical disks**

Click **Create** to add a new logical disk, where up to a maximum of 32 logical disks can be created in each DG. Specify the following options for configuration.

DG ID	Select a DG ID from the drop-down menu. This is the disk group to be assigned for logical disk setting.
LD ID	Select an LD ID from the drop-down menu.
Name	Use the system default name as dgxldy . 'x' is the DG identifier and 'y' is the LD identifier. OR Uncheck the ' Use system default name ' box and enter the name in the Name field. The maximum name length is 63 bytes.
RAID Level	Select a RAID level for the logical disk. Different logical disks in a disk group can have different RAID levels. However, when NRAID is selected, there must be no non-NRAID logical disks in the same disk group.
Capacity (MB)	Enter an appropriate capacity for the logical disk. This determines the number of sectors a logical disk can provide for data storage.
Stripe Size (KB)	4 / 8 / 16 / 32 / 64 / 128 / 256 / 512 The stripe size is only available for a logical disk with a striping-based RAID level. It determines the maximum length of continuous data to be placed on a member disk. The stripe size must be larger than or equal to the cache unit size.
Free Chunk	Each free chunk has a unique identifier in a disk group, which is determined automatically by the controller when a free chunk is created. Select a free chunk from the drop-down menu for logical disk creation.

Initialization Option

Noinit: No initialization process, and the logical disk can be accessed immediately after it is created.

Regular: The controller initializes the logical disk by writing zeros to all sectors on all member disks of the logical disk. This ensures that all data in the logical disks are scanned and erased.

Background: The controller starts a background task to initialize the logical disk by synchronizing the data stored on the member disks of the logical disk. This option is only available for logical disks with parity-based and mirroring-based RAID levels.

Alignment Offset (sector)

Set the alignment offset for the logical disk starting sector to enhance the controller's performance. For Windows OS, it is suggested to set the alignment offset at sector 63.

**Note**

Make sure the disk group to be created for a new logical disk is in OPTIMAL or LD_INIT state, otherwise the new logical disk will not be created.

- **Delete logical disks**

Select the logical disk(s) you want to delete and click **Delete**. To delete all LUNs of **dgxldy**, check the '**Force to delete LUN mapping(s)**' box. All access to the logical disk will be stopped.

- **Modify logical disks**

To modify a setting, select an LD and click **Modify**. Specify the following options for configuration.

Name	Type a name for the DG ID/ LD ID.
Write Cache	This option enables or disables the write cache of a logical disk.
Write Sorting	This option enables or disables the sorting in the write cache. To improve writing performance, it is recommended to turn this option on for random access. This option is available only if the write cache is on.
Read Ahead Policy	Always: The controller performs pre-fetching data for every read command from hosts. Adaptive: The controller performs pre-fetching only for host read commands that are detected as sequential reads. The detection is done by read logs. Off: If there is no sequential read command, read-ahead will result in overhead, and you can disable the read-ahead.
Read Ahead Multiplier	This option specifies the read ahead multiplier for the Always and Adaptive read ahead policies. Select how much additional sequential data will be pre-fetched. The default value is 8.
Read Logs	This option specifies the number of concurrent sequential-read streams for the Adaptive read ahead policy, and the range is between 1 and 128. The default value is 32.

LD Read Algorithm

This option is only available for logical disks with parity-based RAID level, i.e. RAID 3/5/6.

None: None of the algorithms will be used when accessing data disks.

Intelligent Data Computation: The controller will access logical disks within the shortest response time. This greatly enhances read performance.

Fast Read Response: When this option is selected, you are prompted to enter the maximum response time for all read requests. The allowed range for response time is 100 to 15000 msecs.

Check on Read: This option is similar to the Fast Read Response. In addition to reading the requested data from disks, the controller will also perform parity check across corresponding strips on each data disk.

To clear write buffers in the write cache of a logical disk, select a logical disk and click the **Flush** button.

- **Detailed logical disk information**

Click  to display a complete list of logical disk information. You will see the following details.

- DG ID
- LD ID
- UUID
- Created Time and Date
- LD Read Algorithm
- Alignment Offset (sector)
- Write Cache Status
- Write Cache Setting
- Write Sorting
- Read Ahead Policy
- Read Ahead Multiplier
- Read Logs
- Member State

2.6.5 Volumes

This feature allows you to create, delete, and modify your volume settings. RAID 30/50/60 are supported by creating striping volumes over RAID 3/5/6 logical disks.

- **Create volumes**

Click **Create** to add a new volume, where up to a maximum of 32 volumes can be created. Specify the following options for the configuration.

VOL ID	Select a VOL ID from the drop-down menu.
Name	Use the system default name as volx . 'x' is the VOL identifier. OR Uncheck the ' Use system default name ' box and enter the name in the Name field. The maximum name length is 63 bytes.
LD Level	Select a RAID level to filter a list of member LDs.
Member LDs	Select the LDs to be grouped.
Stripe Size (KB)	4 / 8 / 16 / 32 / 64 / 128 / 256 / 512 The stripe size must be larger than or equal to the cache unit size.
Alignment Offset (sector)	Set the alignment offset for volume starting sector to enhance the controller's performance. For Windows OS, it is suggested to set the alignment offset at sector 63.



Note

1. All logical disks must be in the same RAID level.
2. No two logical disks can be in the same disk group.
3. None of the logical disks can be used by other volumes.
4. None of the logical disks can be bound to any LUNs.
5. All logical disks must be in the optimal state.
6. All disk groups of the logical disks must belong to the same owner controller.

- **Delete volumes**

Select the volume(s) you want to delete and click **Delete**. To delete all LUNs of **volx**, check the '**Force to delete LUN mapping(s)**' box. All access to the volume will be stopped.

- **Modify volumes**

To modify a setting, select a volume and click **Modify**. Specify the following options for configuration.

Name	Type a name for the volume ID.
Write Cache	This option enables or disables the write cache of a volume.
Write Sorting	This option enables or disables the sorting in the write cache. To improve writing performance, it is recommended to turn this option on for random access. This option is available only if the write cache is on.
Read Ahead Policy	Always: The controller performs pre-fetching data for every read command from hosts. Adaptive: The controller performs pre-fetching only for host read commands that are detected as sequential reads. The detection is done by read logs. Off: If there is no sequential read command, read-ahead will result in overhead, and you can disable the read-ahead.
Read Ahead Multiplier	This option specifies the read ahead multiplier for the Always and Adaptive read ahead policies. Select how much additional sequential data will be pre-fetched. The default value is 8.
Read Logs	This option specifies the number of concurrent sequential-read streams for the Adaptive read ahead policy, and the range is between 1 and 128. The default value is 32.

To clear write buffers in the write cache of a volume, select a volume and click the **Flush** button.

- **Detailed volume information**

Click  to display a complete list of volume information. You will see the following details.

- VOL ID
- UUID
- Created Time and Date
- Alignment Offset (sector)
- Write Cache Status
- Write Cache Setting
- Write Sorting
- Read Ahead Policy
- Read Ahead Multiplier
- Read Logs

2.6.6 Storage provisioning

The RAID GUI provides three storage provision methods; simple, symmetric, and selective. Whenever you change the method, the following confirmation message is displayed.



Figure 2-11 Method switching message

- **Simple method**

Simple storage is used in direct attached storage (DAS) environments, where there is no FC switch between the RAID and the hosts.

As the illustration shows, any computer is allowed to access the LUNs presented by the controller after gaining access to the host ports of the controller.

LUNs are assigned to each virtual disk in RAID so the host can address and access the data in those devices.

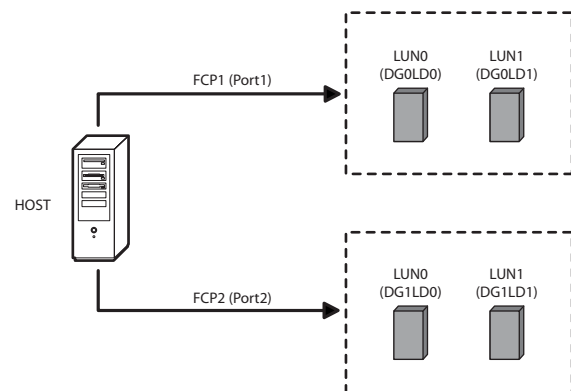


Figure 2-12 Simple storage

Add LUNs in a storage port

In the simple storage main screen, click **Add** to add a LUN to the default storage group of an FC port, **fcpx**, with a virtual disk.

HTP ID	Each FC port has a unique ID, which is determined according to the physical location of the port on the controller. Select one from the drop-down menu.
LUN ID	Select a LUN ID from the drop-down menu, where up to a maximum of 128 LUNs can be selected.
Mapping Virtual Disk	Select a virtual disk from the drop-down menu for LUN mapping.
Sector Size	512Byte / 1KB / 2KB / 4KB Select a sector size from the drop-down menu as the basic unit of data transfer in a host.
Number of Cylinder / Number of Head / Number of Sector	Define a specific cylinder, head, and sector to accommodate different host systems and applications. The default is Auto .
Write Completion	Write-behind: Write commands are reported as completed when a host's data is transferred to the write cache. Write-through: Write commands are reported as completed only when a host's data has been written to disk.

Remove LUNs in storage port

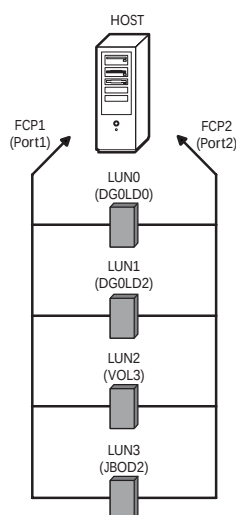
Select the LUN(s) you want to remove and click **Remove**. To remove all LUNs of a virtual disk from the default storage group of **fcpx**, check the **'Remove mapping virtual disk from all storage group'** box.

- **Symmetric method**

Symmetric storage is used in environments where hosts are equipped with multi-path IO (MPIO) driver or software that can handle multiple paths (LUNs) to a single virtual disk.

In this case, the controller's performance is highly elevated. You need not consider different host ports because the bindings between hosts and storage groups are applied to all host ports.

As the illustration shows, LUNs are assigned according to each host's WWPN (World Wide Port Name). Therefore, you need to set the host WWPN first. Each host can recognize LUNs as paths to virtual disks, instead of individual disks.



MPIO Environment

Figure 2-13 Symmetric storage

To set up symmetric storage groups, first add host(s).

Add hosts

In the symmetric storage main screen, click **Host > Add**.

Host ID	Select a Host ID from the drop-down menu. A maximum of 32 hosts can be added to the controller.
WWPN	Each FC port needs a WWPN for communicating with other devices in an FC domain. You can find each WWPN of an FC port in its BIOS.

Host Name	Use the system default name as hostx . 'x' is the Host identifier. OR Uncheck the ' Use system default name ' box and enter the name in the Name field. The maximum name length is 63 bytes.
HG ID	Select a Host Group ID from the drop-down menu. You can select from hg0 to hg31 or No group.

Remove hosts

Select the host(s) you want to delete and click **Remove**. Check the '**Only remove from host group**' box if you want to remove the host(s) from the host group only.

Modify hosts

Select a host you want to change for its host name, host group ID, or host group name, and click **Modify** to enter the settings screen.

Add LUNs in host

After setting the host(s), click **Back** to return to the symmetric storage main screen. Then click **Add** to add LUNs in the host(s).

Host ID	Select a Host ID from the drop-down menu. A maximum of 32 hosts can be added to the controller.
LUN ID	Select a LUN ID from the drop-down menu. where up to 128 IDs are available for the selection.
Mapping Virtual Disk	Select a virtual disk from the drop-down menu for LUN mapping.
Sector Size	512Byte / 1KB / 2KB / 4KB Select a sector size from the drop-down menu as the basic unit of data transfer in a host.
Number of Cylinder / Number of Head / Number of Sector	Define a specific cylinder, head, and sector to accommodate different host systems and applications. The default is Auto .

Write Completion

Write-behind: Write commands are reported as completed when host's data is transferred to the write cache.

Write-through: Write commands are reported as completed only when host's data has been written to disk.

Remove LUNs from host

Select the LUN(s) you want to remove and click **Remove**. To remove all LUNs of a virtual disk from one or all hosts, check the '**Remove mapping virtual disk from all host**' box.

- Selective method**

Selective storage is used in complicated SAN environments, where there are multiple hosts accessing the controller through an FC switch. This method provides the most flexibility for you to manage the logical connectivity between host and storage resources exported by the controller.

As the illustration shows, the HG (Host Group) can be a host or a group of hosts that share the same access control settings in the controller. SG represents the LUNs as a storage group. Bind the host/ host group and storage group to the same host port.

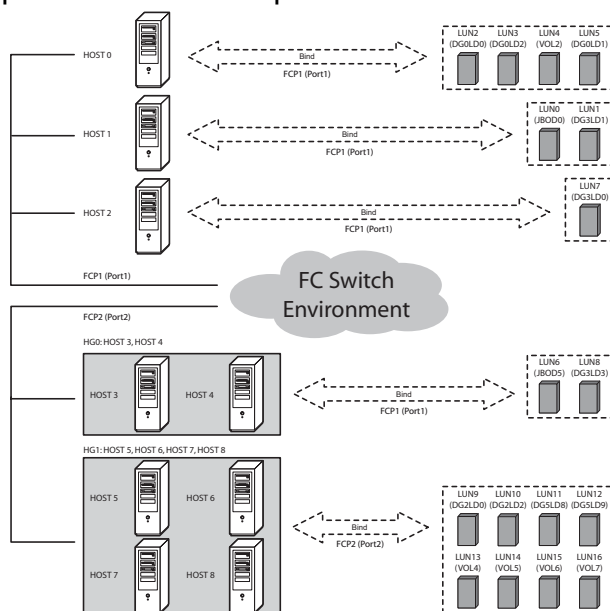


Figure 2-14 Selective storage

Add hosts

In the selective storage main screen, click **Host > Add**.

Host ID	Select a Host ID from the drop-down menu. A maximum of 32 hosts can be added to the controller.
WWPN	Each FC port needs a WWPN for communicating with other devices in an FC domain. You can find the WWPN of an FC port in its BIOS.
Host Name	Use the system default name as hostx . 'x' is the Host identifier. OR Uncheck the ' Use system default name ' box and enter the name in the Name field. The maximum name length is 63 bytes.
HG ID	Select a Host Group ID from the drop-down menu. You can select from hg0 to hg31 or No group.

Remove hosts

Select the host(s) you want to delete and click **Remove**. Check the '**Only remove from host group**' box if you want to remove the host(s) from the host group only.

Modify hosts/host groups

Select a host you want to change for its host name, host group ID, or host group name, and click **Modify** to enter the settings screen.

Add LUNs in storage group

In the selective storage main screen, click **SG > Add**.

SG ID	Select a SG ID from the drop-down menu. A maximum of 34 storage groups can be created in the controller.
LUN ID	Select a LUN ID from the drop-down menu, where up to 128 IDs are available for the selection. A total of 1024 LUNs can be created in the controller.

Mapping Virtual Disk	Select a virtual disk from the drop-down menu for LUN mapping.
Mask Status	Unmask / Mask This option makes a LUN available to some hosts and unavailable to other hosts.
Access Right	Read-only / Read-writable The access right is applied to individual LUNs in a storage group.
Sector Size	512Byte / 1KB / 2KB / 4KB Select a sector size from the drop-down menu as the basic unit of data transfer in a host.
Number of Cylinder / Number of Head / Number of Sector	Define a specific cylinder, head, and sector to accommodate different host systems and applications. The default is Auto .
Write Completion	Write-behind: Write commands are reported as completed when a host's data is transferred to the write cache. Write-through: Write commands are reported as completed only when a host's data has been written to disk.

Remove LUNs in storage group

Select the LUN(s) you want to delete and click **Remove**. To remove all LUNs of a virtual disk from all storage groups, check the '**Remove mapping virtual disk from all storage group**' box.

Modify LUN/storage group

Select a LUN/ storage group you want to change for its mask status, access right, or storage group name, and click **Modify** to enter the settings screen. To configure the same settings to all LUNs in a storage group, check the '**Apply to all LUNs in this storage group**' box.

Bind host/host group and storage group to host ports

Now you can click **Bind** in the selective storage main screen. Select from the **HTP ID**, **Host/ HGID**, and **SG ID** drop-down menu for binding.

Unbind hosts/ host groups and storage groups to host ports

Select a binding you want to cancel and click **Unbind** in the selective storage main screen. Click **Confirm** to cancel the selected binding.

2.7 Maintenance Utilities

This feature allows you to perform maintenance tasks on your arrays.

2.7.1 Expanding disk groups

DG Reconfiguration allows expansion on disk groups by adding one or more disks, thus increasing the usable capacity of the disk group. You can also perform defragmentation during expansion.

To expand disk groups, do the following:

1. Select **Maintenance Utilities > DG Reconfiguration** from the main menu.
2. Click **Expand** and specify the following options for a DG expansion task.

DG ID	Select a disk group for expansion from the drop-down menu.
Expanding HDDs	Select and use the arrow buttons to move one or more unused hard disks from the <i>Available HDDs</i> list to the <i>Expanding HDDs</i> list.
Schedule	Immediately: The task will start immediately. Once: The task will start on the specified date and time.
Defragment during expanding	Check this option to allow for defragmentation during expansion.

3. Click **Apply** to review the current settings.
4. Click **Confirm**. The task is created.



Note

1. The disk group to be expanded must be in the optimal state.
2. You may only select to increase the number of hard disks but not to change the disk group setting.
3. Once confirmed, please wait until the expansion process is complete. Do not change or select any functions during the expansion process.

2.7.2 Defragmenting disk groups

Except defragmenting disk groups during expansion, there is another way to perform the task.

1. Select **Maintenance Utilities > DG Reconfiguration** from the main menu.
2. Click **Defragment** and specify the following options for defragmenting.

DG ID	Select a disk group to defragment from the drop-down menu.
Schedule	Immediately: The task will start immediately. Once: The task will start on the specified date and time.

3. Click **Apply** to view the current settings.
4. Click **Confirm**. The task is created.

After defragmentation is complete, all free chunks will be consolidated into the one free chunk located in the space at the bottom of member disks.



Note

1. Defragmentation does not support NRAID disk group.
2. There must be free chunks and logical disks on disk groups.

2.7.3 Changing RAID level / stripe size for logical disks

LD Reconfiguration supports stripe size and RAID level migration for logical disks. You can conduct disk group expansion with migration at the same time.

To change the RAID level or stripe size of a logical disk, do the following:

1. Select **Maintenance Utilities > LD Reconfiguration** from the main menu.
2. Click **Migrate** and specify the following options for an LD migration task.

DG ID/LD ID	Select a DG ID and an LD ID from the drop-down menu for migration.
Expanding HDDs	The controller performs disk group expansion with specified hard disks.
RAID Level	The controller performs the specified RAID level migration. The feasibility of migration is limited to the original and final RAID level and the number of member disks in the disk group. The following table defines the rules of the number disks during the RAID migration.

Table 2-10 Limitations of the number of member disks

Old New	RAID 0	RAID 1	RAID 10	RAID 3/5	RAID 6
RAID 0	$N_n \geq N_o$	OK	OK	OK	OK
RAID 1	N/A	$N_n > N_o$	N/A	N/A	N/A
RAID 10	$N_n \geq N_o * 2$	OK	$N_n \geq N_o$	$N_n \geq (N_o - 1) * 2$	$N_n \geq (N_o - 2) * 2$
RAID 3/5	$N_n \geq N_o + 1$	OK	OK	$N_n \geq N_o$	OK
RAID 6	$N_n \geq N_o + 2$	OK	OK	$N_n \geq N_o + 1$	$N_n \geq N_o$

* Where “Nn” means the number of member disks in the new RAID level, “No” means the number of member disks in the original/old RAID level, “OK” means the migration is always possible, and “N/A” means the migration is disallowed.

Stripe Size (KB)	This option must be specified when migrating from a non-striping-based RAID level to a striping-based RAID level.
-------------------------	---

Schedule	Immediately: The task will start immediately. Once: The task will start on the specified date and time.
Defragment during migration	Check this option to allow defragmentation during migration.

2.7.4 Expanding the capacity of logical disks in a disk group

To expand the capacity of a logical disk, do the following:

1. Select **Maintenance Utilities > LD Reconfiguration** from the main menu.
2. Click **Expand** and specify the following options for an LD expansion task.

DG ID/LD ID	Select a DG ID and an LD ID from the drop-down menu for expansion.
--------------------	--

Capacity (MB)	The capacity of a logical disk can be expanded if there is a free chunk available on the disk group.
----------------------	--



Note

1. The new capacity must be bigger than the current capacity.
2. The sum of increased capacity of all logical disks on the disk group must be less than or equal to the sum of capacity of all selected free chunks.

Schedule	Immediately: The task will start immediately. Once: The task will start on the specified date and time.
-----------------	--

Starting Free Chunk / Ending Free Chunk	This option specifies the start and end of free chunks to be used for the expansion. The Ending Free Chunk must be bigger than or equal to the Starting Free Chunk .
--	--



Note

At least one free chunk must be adjacent to the logical disk.

Initialization Option	Background / Noinit Background applies only to the logical disks with parity-based RAID level or mirroring-based RAID level.
------------------------------	--

3. Click **Apply** to view the current settings.
4. Click **Confirm**. The task is created.

2.7.5 Shrinking logical disks

The shrink operation conducts without background task; it simply reduces the capacity of the logical disk.

To release free space of a logical disk on a disk group, do the following:

1. Select **Maintenance Utilities > LD Reconfiguration** from the main menu.
2. Click **Shrink** and specify the following options for an LD shrink task.

DG ID/LD ID	Select a DG ID and an LD ID from the drop-down menu for shrink.
Capacity (MB)	Enter the new capacity for the specified logical disk to be shrunk. Note that the new capacity must be higher than zero.



Note

It is advised that the file systems on the host be shrunk before shrinking the logical disks; otherwise shrinking might cause data loss or file system corruption.

3. Click **Apply** to view the current settings.
4. Click **Confirm**. The task starts.

2.7.6 Expanding volumes

To expand the capacity of a volume, do the following:

1. Select **Maintenance Utilities > VOL Reconfiguration** from the main menu.
2. Select **Expand** and specify the following options for a VOL expansion task. The expansion volume is formed by concatenating new logical disks.

VOL ID	Select a VOL ID from the drop-down menu for expansion.
LD Level	Select a RAID level to filter a list of expanding LDs.
Expanding LDs	Select and use the arrow buttons to move one or more LDs from the <i>Available LDs</i> list to the <i>Expanding LDs</i> list.



Note

1. The volume must be in optimal state.
2. The maximum number of member logical disks for each volume is eight.
3. No two logical disks can be in the same disk group.
4. None of the logical disks can be used by other volumes.
5. None of the logical disks can be bound to any LUNs.
6. All logical disks must be in the optimal state.
7. All disk groups of the logical disks must belong to the same owner controller.

3. Click **Apply** to view the current settings.
4. Click **Confirm** to continue the expansion.

2.7.7 Shrinking volumes

The shrink operation conducts without background task; it simply reduces the capacity of the volume by removing the concatenating volume units.

To release free space of a volume, do the following:

1. Select **Maintenance Utilities > LD Reconfiguration** from the main menu.
2. Select **Shrink** and specify the following options for a VOL shrink task.

VOL ID	Select a VOL ID from the drop-down menu for shrink.
Shrinking VUs	Select member VUs you want to remove from the list and use the arrow buttons to move them to the <i>Shrinking VUs</i> list.



Note

1. The volume must be in optimal state.
2. There must be at least two concatenating volume units in a volume.
3. All selected volume units must be the last concatenating volume units in the volume.

3. Click **Apply** to view the current settings.
4. Click **Confirm** to continue the shrink.

2.7.8 Cloning hard disks

When a hard disk is likely to become faulty or develop errors, for example, when the number of reported errors or bad sectors of a physical disk increases over a certain threshold, or a disk reports SMART warning, you can copy all the data on the disk to another disk.

To clone a hard disk, do the following:

1. Select **Maintenance Utilities > HDD Clone** from the main menu.
2. Click **Clone** and specify the following disk cloning options.

Source Disk	Select a source disk you want to clone. The disk must not be in an NRAID disk group.
Target Disk	Select the target disk to be the clone. The disk must be either unused, a global spare, or a local spare of the same disk group as the Source Disk .

Schedule	Immediately: The task will start immediately. Once: The task will start on the specified date and time.
Automatic Resume	During cloning, if the target disk fails, the controller will use another disk and resume cloning. [The Auto Spare Control option (see 2.7.15 Miscellaneous) must be set to On.] The following is the order of disks used to resume cloning: 1. Local spare disks 2. Global spare disks 3. Unused disks If there is no disk to resume cloning, or this option is not specified, cloning is aborted when the target disk fails.



Note

1. If there is disk scrubbing task or parity regeneration task in the disk group of the source disk, the task is aborted and cloning is started.
2. If the disk group of the source disk contains faulty disks, cloning is suspended until the disk group completely rebuilds its disks.

3. Click **Apply**. The task will start according to the specified time.

To cancel hard disk cloning, do the following:

1. Select the task(s) and click **Stop** to abort disk cloning. A confirmation prompt displays. Click **Confirm** to cancel the cloning task.

The target disk will become an unused disk. If there is a degraded disk group and auto-spare option is on, the target disk will be used for rebuilding.

2.7.9 Scrubbing

This feature supports parity check and recovery for disk groups, logical disks, and hard disks. Bad sectors will be reported when detected.

To perform disk scrubbing on a disk group, do the following:

1. Select **Maintenance Utilities > Scrubbing** from the main menu.
2. Click **Scrub** and specify the following options for a disk scrubbing task.

Target Type	Select either HDD or DG as the scrubbing disk type. HDD: Specify an HDD ID for scrubbing. DG: Specify a DG ID and an LD ID/All LDs for scrubbing.
Parity Check	This option is only available for parity-based RAID level LDs. None: No parity check is performed. Check Only: The controller checks the parity for logical disks. Regenerate: Any parity inconsistency detected is regenerated by the controller.
Schedule	Immediately: The task will start immediately. Once: The task will start on the specified date and time. Weekly: The task will start on the specified day and time every week. Monthly: The task will start on the specified date and time every month.

3. Click **Apply**. The task will start according to the specified time.



Note

1. The hard disk must not be a member disk of a disk group.
2. The disk group and logical disk(s) for scrubbing must be in the optimal state.
3. The scrubbing task will be aborted if the disk group enters degraded mode, starts rebuilding disk, or starts disk cloning.
4. If the disk group of the source disk contains faulty disks, scrubbing is aborted until the disk group completely rebuilds its disks.

To cancel disk scrubbing, do the following:

1. Select the task(s) and click **Stop** to abort the disk scrubbing. A confirmation prompt displays. Click **Confirm** to cancel the scrubbing task.

2.7.10 Regenerating the parity

This feature is less complicated than scrubbing. This command regenerates the parity of a logical disk or all logical disks on disk groups without parity checking. Follow the steps below to create a regenerating parity task.

1. Select **Maintenance Utilities > Regenerate Parity** from the main menu.
2. Click **Reg-parity** and specify the following options for a parity regeneration task.

DG ID/LD ID	Select a DG ID and an LD ID or All LDs from the drop-down menu for parity regeneration.
Schedule	Immediately: The task will start immediately. Once: The task will start on the specified date and time. Weekly: The task will start on the specified day and time every week. Monthly: The task will start on the specified date and time every month.

3. Click **Apply**. The task will start according to the specified time.

To stop parity regeneration, do the following:

1. Select the task(s) and click **Stop**. A confirmation prompt displays. Click **Confirm** to stop the parity regeneration task.

2.7.11 Performing disk self test

This feature instructs the hard disks to start or stop short or extended disk self test (DST). The test performs a quick scan for bad sectors. To execute this function, make sure the SMART warning has been turned on. (See **2.8.1 Hard disks**)

Follow the steps below to start a disk self test:

1. Select **Maintenance Utilities > Disk Self Test** from the main menu.
2. Select the hard disks you want to perform the disk self test and click **DST**. Specify the following options.

Schedule	Immediately: The task will start immediately. Once: The task will start on the specified date and time. Weekly: The task will start on the specified day and time every week. Monthly: The task will start on the specified date and time every month.
Perform extended disk self test	Check this option to start an extended disk self test. Without this option, the hard disks perform short disk self test.

3. Click **Confirm** to begin testing.

To stop the DST of a hard disk, select it and click **Stop**. A confirmation prompt displays. Click **Confirm** to end the DST.



Note

1. Hard disks must support DST.
2. Hard disks must not be executing DST.
3. For ATA disks, the SMART must be turned on.
4. For ATA disks, if SMART is turned off during DST execution, DST will be aborted.
5. During DST execution, accessing the hard disks may lead to performance degradation.
6. For scheduling DST, the disk must be either unused, a global spare, a local spare, or a JBOD.

2.7.12 Array roaming

Array roaming will be activated when hard disks are moved from one slot to another or from one controller to a new controller. This ensures that the new controller can be working at all times. You can determine the way of array roaming through the Auto Array Roaming Control (See **2.7.15 Miscellaneous**).

When the Auto Array Roaming Control option is enabled, the configuration of the disks can be identified and restored and uncompleted tasks are automatically resumed.

Some hard disk configurations may cause conflicts when moved to a new controller. You are allowed to view group information, including the virtual disk and hard disk states, from the **Array Roaming** page



Note

At the top of the page, you can select the group id and the group type (JBOD disk, disk group, or volume) for the information to be displayed. Each group type will have different columns on this page.

To import the foreign/conflict disks, click the **Import** button and specify the following options.

Target ID	Select an ID (which may be a JBOD ID, disk group ID, or volume ID) to be used after import.
Members	Select the foreign/conflict hard disks to be imported and restored the configurations. Use the arrow buttons to move the hard disks from the <i>Available Members</i> list to the <i>Selected Members</i> list.
Force to import abnormal group	Check this option to allow the import of incomplete disk groups. Without this option, only normal disk groups and volumes can be restored.

2.7.13 Array recovery

With the Array Recovery Utility (ARU), you can recover the disk groups, logical disks, and volumes. ***To perform recovery, you must fully understand the partition state of each logical disk.***

A partition of a logical disk can be one of the following states: OPTIMAL, FAULTY, BANISH, REBUILD, or UNTRUST. Each state is described as below:

- **OPTIMAL:** The partition is working and the data is valid.
- **FAULTY:** The partition is lost (the member disk is removed or faulty) and it results in a faulty logical disk. The data on the faulty partition will be still in sync with data on other partitions. The data on the faulty partition can be used after recovery.
- **BANISH:** The partition is lost (the member disk is removed or faulty) and it results in a degraded logical disk. The data on the banish partition will be out of sync with data on other partitions. The data on the banish partition can be used after recovery.
- **REBUILD:** The member disk of the partition has been added to the logical disk, and the partition is rebuilding the data.
- **UNTRUST:** The member disk of the partition has been added to the logical disk, but the data on the partition cannot be trusted. It can become trusted if the logical disk can rebuild the data on the partition.

- **Partition state transition**

The corresponding events and state transitions of a partition are shown in the table below:

Table 2-11 State transition

From	To
Disk is failed or removed.	
OPTIMAL	FAULTY: for faulty logical disk BANISH: for degraded logical disk
REBUILD	BANISH
UNTRUST	BANISH
Lost member disk is replaced by a new disk for disk rebuilding.	
FAULTY	UNTRUST (The logical disk is not recoverable.)
BANISH	UNTRUST (and later to REBUILD)
Lost member disk is restored to a disk group by the ARU.	
FAULTY	OPTIMAL
BANISH	UNTRUST (and later to REBUILD)
Force to recover a logical disk by the ARU.	
UNTRUST	OPTIMAL
Force to recover a logical disk by the ARU.	
UNTRUST	REBUILD
The partition completes data rebuilding.	
REBUILD	OPTIMAL

Before logical disk recovery, make sure the following:

- There are enough hard disks in the disk group.
- No background tasks in progress, such as disk rebuilding or RAID reconfiguration.
- No reconfiguration tasks are performed by the faulty logical disk.

- **Start a recovery**

When there are any hard disk conflicts, there might be faulty disk groups, logical disks, or volumes on your controller. You can perform DG recovery to restore lost member disks to a disk group. The faulty logical disks on the disk group are recovered automatically when the disk group is recovered.

To perform a disk group recovery, do the following:

1. Select **Maintenance Utilities > Array Recovery** from the main menu.
2. Select **DG** from the Recovery Type drop-down menu.
3. Select a disk group, and click **Recover**.
4. The **Restore the Array** window displays. Select the original member disks to restore.

**Note**

1. If a non-member disk is selected, check the **Force to recover disk** option and specify the Disk Member Index. Make sure the recovery index is correct.
2. To reduce the possibility of data loss, ensure that the recovery order is correct when the **Force to recover disk** option is chosen.

5. Click **Apply** and a confirmation prompt displays. Click **Confirm**.
6. The disk group recovery starts. Rebuilding will also start for degraded logical disks on a disk group.

If the logical disk is not recovered automatically after disk group recovery, perform logical disk recovery. After logical disks are restored, you can perform the volume recovery to restore the lost member logical disks to a volume.

2.7.14 Schedule task

The DG reconfiguration, LD reconfiguration, disk cloning, disk scrubbing, and DST scheduled tasks are listed in the **Schedule Task** section. When the scheduled date and time is met, the controller will start the specified tasks.



Note

The controller will try to launch commands according to the schedule. However, if the command cannot be executed at that moment, the controller will not retry.

To cancel a scheduled task, select it and click **Delete**. A confirmation prompt displays. Click **Confirm** to delete the selected task.

2.7.15 Miscellaneous

In this section, you can configure the following settings to the controller. The settings of Cache Unit Size, Auto Array Roaming Control, and Write Log Control will take effect after you restart the RAID subsystem.

Auto Spare Control: On (default) / Off

If this option is enabled, and there is no global spare disk, unused hard disks are used for rebuilding. If there are multiple unused disks, the disk with the lowest hard disk identifier will be used.

Spare Restore Control: On / Off (default)

If this option is enabled, the controller will restore the data from the spare disk to a new replacement disk when inserted. This allows the user to keep the same member disks as original.

Cache Unit Size (KB): 4 / 8 / 16 / 32 / 64 / 128 (default)

The cache unit size must be smaller or equal to the minimum stripe size of existing logical disks.

Write Cache Periodic Flush (second): 5 (default)

Specify the period in seconds to periodically flush the write cache. If 0 is specified, periodic cache flushing is disabled. The range is from 0 to 999.

Write Cache Flush Ratio (%): 45 (default)

Specify the dirty write buffer watermark. When the specified percentage is reached, the system will start to flush the write buffers immediately. The range is from 1% to 100%.

Auto Array Roaming Control: On / Off (default)

On: Enable imported foreign hard disks when the controller is started. Foreign hard disk configurations are also restored.

Off: Disable imported foreign hard disks when the controller is started.



Note

Hard disks with configurations that conflict with controller configurations are not imported and enter conflict state.

On-line Array Roaming Control: On / Off (default)

On: The controller will try to keep the disk in the foreign state if hard disk contains valid meta-data. However, if the disk fails to import successfully, it will enter the conflict state.

Off: All on-line installed disks are perceived as new disks and enter unused state. Meta-data on the disk is cleared and reset.

Write Log Control: On (default) / Off

The consistency of parity and data might not be retained because of improper shutdown of the controller. This option enables or disables write logging for parity consistency recovery.



Note

1. Enabling write logging will cause slight performance degradation.
 2. Write logging is only effective to logical disks with parity-based RAID levels.
 3. To guarantee the consistency of data and parity by write logging, the on-disk cache must be turned off.
-

Meta-data Update Frequency: Low (default) / Medium / High

This option specifies the frequency to update the progress of background tasks, except reconfiguration tasks.

Task Notify: On / Off (default)

Select this option to enable or disable the event notification when the background task is completed to a specified percentage. The range is from 1% to 99%.

2.8 Hardware Configurations

2.8.1 Hard disks

In this section, you can configure the following settings to all hard disks.

Utilities Task Priority: Low (default) / Medium / High

This option determines the priority of the background tasks for utilities of all hard disks not belonging to any disk group, such as scrubbing and cloning.

SMART Warning: On / Off (default)

This option is only for SMART function supported hard disks. The SMART function serves as a device status monitor.

Period of SMART Polling (minute): 60 (default)

This option is only available when the SMART warning is turned on. Specify the period in minutes to poll the SMART status from hard disks periodically.

SMART Action: Alert (default) / Clone

This option is only available when the SMART warning is turned on. The controller will alert you or start disk cloning when a disk reports a SMART warning.

Disk IO: timeout after 30 (default) sec(s) and retry 1 (default) time(s)

Timeout value (in unit of seconds): If a hard disk does not respond to a command within this time, the controller will reset and reinitialize the hard disk, and retry the command. The possible values are 1 to 60.

Retry times: Specify the number of retries when a disk IO command fails. The possible values are 0 to 8.

Transfer Speed: Auto (default) / 1.5GB / 3GB

This option specifies the transfer speed of a hard disk. When **Auto** is specified, the transfer speed is determined by the controller according to the best transfer mode supported by the installed hard disks.

Bad Block Alert: On / Off (default)

This option enables or disables event alerts for bad block reallocation. After selecting **On**, four blank fields are displayed for you to specify the percentages of reserved bad block reallocation space. The default values are 20, 40, 60, and 80.

Bad Block Alert :	On	▼	in	20	% /	40	% /	60	% /	80	%
Bad Block Clone :	On	▼	in	50	%						

Figure 2-15 Specify the percentage for Bad Block Alert



Note

1. Latter percentages must be larger than the former percentages.
2. Percentages must be integers between 1 and 100.

Bad Block Clone: On / Off (default)

This option enables or disables disk cloning for bad block reallocation. After selecting **On**, a blank field is displayed for you to specify the percentage of reserved bad block reallocation space. When the specified space is reached, disk cloning will be started. The default value is 50.

Bad Block Alert :	On	▼	in	20	% /	40	% /	60	% /	80	%
Bad Block Clone :	On	▼	in	50	%						

Figure 2-16 Specify the percentage for Bad Block Clone



Note

1. Percentages must be integers between 1 and 100.
2. Cloning can only be started when there are local or global spare disks.

Bad Block Retry: On (default) / Off

Select this option to enable or disable retrying when bad block reallocation fails.

IO Queue: On (default) / Off

Select this option to enable or disable *Negative Command Queue (NCQ)*, which enhances hard disk read performance.

Disk Standby Mode: On / Off (default)

Select this option to enable or disable disk standby mode after a period of host inactivity.

Disk Access Delay Time (second): 15 (default)

Specify the delay time before the controller tries to access the hard disks after power-on. The range is between 15 and 75.

Delay Time When Boot-Up (second): 40 (default)

Specify the delay time before the controller automatically restarts. The range is between 20 and 80.



Caution

The boot-up delay time must be longer than the disk access delay time plus 5 seconds.

2.8.2 FC ports

This shows information about FC ports, including each port's ID, name, WWPN, Hard loop ID, connection mode (private loop, public loop, or point-to-point), and data rate. To change the settings, follow the instructions given below:

1. Select an FC port and click **Modify** to open the configurations window.
2. Specify the following options.

Name	Type a name associated with each FC port. The maximum name length is 15 bytes.
Hard Loop ID	Select a fixed loop ID for each FC port from the drop-down menu. To disable hard loop ID, select Auto . The loop ID is automatically determined during loop initialization procedure.
Connection Mode	Auto: The controller will determine the connection mode automatically. Arbitration loop: This is a link that connects all the storages with the host, which enables data transferring. Fabric: This is a point to point connection mode without a switch.
Data Rate	Auto / 1GB / 2GB / 4GB Select a preferred data rate for an FC port or all FC ports.

3. Check the “**Apply connection mode and data rate to all FC ports**” option if necessary.
4. Click **Apply** and the ‘Restart to Apply’ prompt box appears. Click **Restart** to restart the controller immediately, or **OK** to restart later.
5. All settings except FC port name are effective after you reconnect the controller.

2.8.3 COM port

In this section, you can configure the terminal settings on the COM port as instructed below. Select Terminal, and click **Modify** to open the configurations window.

- **Terminal port**

The terminal port serves as one of the mechanisms to manage the controller on-site. The configurations for the terminal ports are baud rate, stop bit, data bit, parity check, and flow control.

To change the settings, specify the following options:

Baud Rate: 2400 / 4800 / 9600 / 19200 / 38400 / 57600 / 115200
(default)

Stop Bit: 1(default) / 2

Data Bit: 7 / 8 (default)

Parity Check: None (default) / Even / Odd

Flow Control: None (default) / HW

2.9 Event Management

Event Management enables or disables event notifications. When an event is detected, the controller will alert you by the specified notification methods. All the events will be recorded in the controller. You are allowed to erase and download the log, and send a test email of events.

2.9.1 Setting up the SMTP

The controller can notify you when an event occurs by sending a mail to the specified user account. Specify the following options for event configurations.

Notify State: On / Off (default)

This option enables or disables the SMTP event notifications.

Mail Subject: RAID system event notification (default)

Enter the mail subject. The maximum length is 31 bytes.

Mail Content: By default, there is no content.

Enter the mail content. The maximum length is 47 bytes.

Mail Retry Period (minute): 10 (default)

Specify the period of time in minutes to retry sending event notification mail. The range is from 10 to 60.

Mail Delay Time (second): 10 (default)

Specify the delay time in seconds to send out multiple events in one mail. This helps to reduce the number of mails. The range is from 5 to 60.

Add Event Receivers

You can add a maximum of three mail recipients. Click **Add** to set the receiver ID, mail receiver address, and the corresponding severity level.

Remove Event Receivers

Select the mail recipient(s) you want to delete and click **Remove**. The selected mail recipients are deleted.

Modify Event Receivers

Select a mail recipient you want to change for its mail address and the event severity level. Click **Modify** to enter the settings screen.

2.9.2 Setting up the SNMP

SNMP traps are used by network entities to signal abnormal conditions to management stations (referred to as SNMP servers in the following paragraphs). The Notify State option allows you to enable or disable SNMP event notification. When set to On, the controller notifies you when an event occurs by sending SNMP traps to the specified SNMP servers.

Add SNMP Servers

You can add a maximum of three SNMP servers. Click **Add** to set the Server ID, SNMP server address, port, and the corresponding protocol version, community name, and severity level.



Note

To receive SNMP traps, an SNMP application must be installed on the SNMP server, and configured properly for receiving traps. The configuration settings of the SNMP application must be the same as those configured on the controller.

Server ID: 0 / 1 / 2

Select a server ID from the drop-down menu.

Server Address: IP Address / Domain Name

Set up the IP address or the domain name of the SNMP server.

Port

Set up the port on which the SNMP server listens. The controller will send SNMP traps to this port. The port number must therefore be the same as that configured on the SNMP application.

SNMP Version: v1 (default) / v2c

Specify the SNMP version. Both versions are exactly the same. However, some SNMP applications may not support SNMPv2c.

Community Name

The community name must be the same as that configured on the SNMP application. The default SNMP community name on most SNMP applications is "public."

Severity Level: Notice (default) / Warning / Error / Fatal

Events with a severity level higher than the specified one will be sent via SNMP traps.

Remove SNMP Servers

Select the SNMP server(s) you want to delete and click **Remove**. The selected SNMP server(s) are deleted.

Modify SNMP Servers

Select the SNMP you want to change for the settings and then click **Modify** to enter the settings screen.

Send a Test SNMP Trap

Select the SNMP server(s) to which a test SNMP trap will be sent, and click **SNMP**. The test SNMP trap will contain message "This trap is for testing purpose only."

2.9.3 Event logs

When the state of a logical or physical component in the controller changes, such as failure of hard disks or completion of a background task, an event occurs.

Events are classified into different severity levels. You can view the events according to the different categories. Specify the severity level at the top of the page.

Events are listed in the event log from newer to older. The events contain the following information:

1. Sequence number
2. Severity level of the event
3. Date and time when the event is occurred
4. The message text of the event, its associated parameters, and event identifier.

For the complete list of event messages, refer to “**Appendix C: Event Log Messages.**”

Erase Event Log

To clear all the records in the event log, click **Erase**. A confirmation prompt displays. Click **Confirm** and all records will be erased.

Download Event Log

To download all the records in the event log, click **Download**. Select a file type from the drop-down menu, and click **Apply**

File Type	.csv (excel-readable) / .txt (human-readable) / .bin (for system suppliers)
	Click on the link in the following pop-up message and the File Download window displays. Select Save and the download task begins. If .txt is specified as the file type, right click the link to save the file.

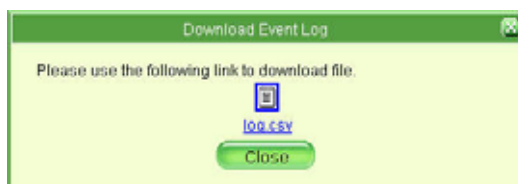


Figure 2-17 Event log download message

Click **Close** to close the window.

**Note**

The event log file stores details of controller activity. In the case of malfunction, this data can be analysed by the user to determine the cause(s).

Record Event Log

Click **Configure** and specify the **Lowest severity of events** option for the events you want to record on NVRAM. The events with severity levels higher than the specified one will be recorded. The default severity level is *info*, which means events of all severity levels will be recorded.

Send a Test Mail

Click **Configure** and specify the **Severity of testing event** option to send a test mail. A testing event record will be generated according to the selected severity level. This helps users to test the event logging and notifications setup.

**Note**

Before sending out the test mail, you need to turn on the event notification and specify the event receivers. (Refer to **2.9.4 Miscellaneous.**)

2.9.4 Miscellaneous

Beeper Control: On (default) / Off / Mute

This option controls the controller's beeper.

On: The beeper sounds during exceptional conditions or when background tasks make progress. By default, the beeper is on.

Off: The beeper is quiet all the time.

Mute: This temporarily mutes the beeper, but it beeps again if exceptional conditions still exist.

Auto Write-Through Cache

This option enables or disables the auto write-through function for the following four types of events.

1. Battery Backup Module Failure
2. Power Supply Unit Failure
3. Fan Failure
4. UPS Failure

When events are detected with a specified type, both the cache on the controller and disk will be automatically set as write-through. After the failure or warning condition is removed, the cache settings will be restored to your original configuration.

To make the settings effective, click **Apply**.

2.10 System Management

2.10.1 Restoring to factory settings

To clear the NVRAM or hard disk configurations, do the following:

1. Select the **“Erase configurations on NVRAM”** or the **“Erase configurations on HDD(s)”** option to clear all configurations made on NVRAM or hard disks.
2. When the **“Erase configurations on HDD(s)”** option is selected, specify the hard disks or a hard disk to clear the configurations on it.
3. Click the **Apply** button, and the erase configuration message appears. Click **Confirm** to restore factory default values.



Note

1. The **“Erase configurations on HDD(s)”** option will be available only when hard disks are in foreign, conflict, or unknown state.
2. After the erase command is applied to NVRAM, the controller will restart immediately.

2.10.2 NVRAM configuration

The controller's configurations are stored in either NVRAM or hard disk(s) depending on configuration types. The following options allow you to manage the configuration data.

Save the NVRAM configuration to HDD(s)

Specify this option to save the NVRAM configuration data to a hard disk or all hard disks.

Warning: The controller will restart immediately when a user restores user configurations.

☒ Save the NVRAM configurations to HDD(s)

☐ Apply to all HDDs

hdd3
hdd4
hdd5

☐ Read the NVRAM configurations from HDDs and save to the NVRAM

☐ Get main configurations

☐ Upload a configuration file and store it as the controller's main configurations

Apply

Figure 2-18 Options in the Configurations screen-1 (System Management menu)

Read the NVRAM configuration on hard disks and save to NVRAM

Specify this option to read the NVRAM configuration data on the specified hard disk and save to NVRAM.

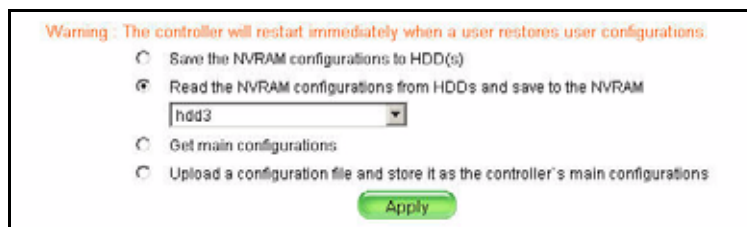


Figure 2-19 Options in the Configurations screen-2 (System Management menu)



Note

This option will be available when on-line hard disks exist. Therefore, only on-line hard disks will be displayed in the list box.

Get main configurations

Specify this option to save the NVRAM configuration data to a file. The following three options are available:

.bin (for user to backup configuration): The configuration data is saved as config.bin.

.txt (human-readable): The configuration data is saved as config.txt.

.txt (to send human-readable mail): The configuration data is saved as config.txt, which is then sent to a specified mail receiver. When this option is selected, enter a mail address for the receiver.

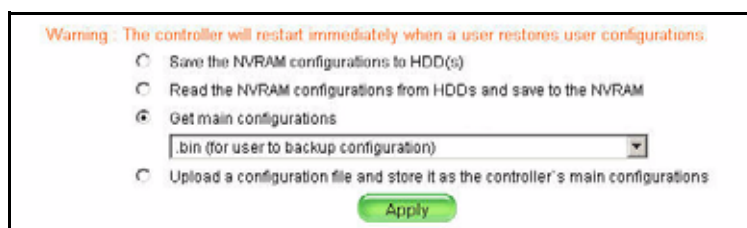


Figure 2-20 Options in the Configurations screen-3 (System Management menu)

Upload a file and store it as the controller's main configurations

Specify this option to upload a configuration file and store it on NVRAM.



Figure 2-21 Options in the Configurations screen-4 (System Management menu)

2.10.3 Setting up the network

The network interface serves as one of the methods to manage the controller. There are two network types, static and DHCP.

To set up the network, do the following:

1. Select **System Management > Network** from the main menu.
2. From the Assignment Method drop-down menu, select either static or DHCP.
 - If you select the static method, assign the IP address, network mask, gateway, and DNS Server to the network.
 - If you select the DHCP method, assign the DNS server address.
3. Click **Apply**, and the settings are effective immediately.



Note

If DHCP is selected for the network, you need to close the GUI and use the new IP for the connection.

Reset SMTP server

Select a server you want to clear the SMTP configurations from, and click **Reset**.

Configure or Modify SMTP server

Select a server you want to configure and click **Modify**. The configurations window opens. Enter the information for the following options

Server Address	Set the SMTP server address.
Sender Account	Set the account to be used on the SMTP server.
Authentication	Turn the authentication on or off for the SMTP server.
Password	Set the password of the account on the SMTP server.
Name	Set the name to be shown in the sender field. If this option is not set, the sender account on the SMTP will be used.

Test SMTP server

Select a server and click **Test SMTP** to ensure the SMTP server is correctly configured. The **Send Test Mail** window displays. Enter an email address for testing.



Note

The primary and secondary server must not be the same SMTP server and sender.

2.10.4 Setting up the time

Time is required for the controller to record events and to schedule maintenance tasks. There are two time modes for selection, static and NTP settings.

For network settings, do the following:

1. Select **System Management > Time** from the main menu.
2. From the Time Mode drop-down menu, select either static or NTP.
 - If you select the static mode, specify the date, time, and time zone. The data and time is set in form as *MM/DD/YY* and *hh/mm*.
 - If you select the NTP mode, specify the time zone and the IP address or the domain name of the NTP server. The NTP server automatically synchronizes the controller clock at 23:59 every day.
3. Click **Apply**, and the settings are effective immediately.

2.10.5 Security control

The settings in the **Security** page allows you to change the password and login related settings.

- **User setting**

To change the password of a specified user, do the following:

1. Specify either Administrator or User from the **Specified User** drop-down menu.
2. Check the “**Change Password**” checkbox, and a pull-down menu appears. Fill in the passwords in each field.
3. If you want to enable or disable password checking before login, specify the options from the **Password Check** drop-down menu.

- **Global Setting**

To enable or disable the auto logout function, select either **On** or **Off** from the **Auto Logout** drop-down menu. By default, the auto logout time is 10 minutes.

Set the **Password Reminding Mail** option to **On** to enable the controller to send out a password reminding email when users forget their password. An email account is also required.

- **SSL Setting**

A secure connection is always required to login to the GUI; therefore, ‘SSL Forced’ is enabled by default and users are forced to connect to the system via HTTPS.

To disable forced SSL encryption, select either **On** or **Off** from the **SSL Forced** drop-down menu.

When all the settings are complete, click **Apply** to make them effective immediately.

2.10.6 System information

To view system information and controller information, select **System Management > System Information** from the main menu. You will see the following details.

System Information	• System Name • Vendor Name • Model Name • Product Revision • Product Serial Number
Controller Information	• Controller ID • RAM Size (MB) • Serial Number • Controller Name

2.10.7 Battery backup module

To view battery information, ensure that a battery backup module is connected. Select **System Management > Battery Backup Module** from the main menu, and the battery information will be displayed in this page. Use the BBM Control option to turn on or off the BBM icon shown in the Monitor mode

Battery Information	• State • Serial Number • Device Chemistry • Remaining Capacity • Remaining Time to Full (minute) • Voltage (V) • Current (A) • Temperature (°C/°F) • Non-critical Temperature (°C/°F) • Critical Temperature (°C/°F)
----------------------------	---

2.10.8 Update the firmware and boot code

To update the system's firmware and boot code, do the following:

1. Select **System Management > Firmware Update** from the main menu.
2. Specify the firmware type; the current firmware and boot code version will be also displayed on-screen.
 - For firmware update, click on the System F/W radio button.
 - For boot code update, click on the Boot Code radio button.
3. Click **Browse** to select an update file.
4. Click **Apply**, and a confirmation prompt displays. Click **Confirm** to continue.
5. The controller will immediately start the update task in the background.



Note

1. Make sure the uploaded firmware is newer than the current version, otherwise the system may not work properly.
2. When updating the firmware and boot code, do not perform any actions in GUI or power off the controller.

2.10.9 Restart or halt the controller

When you want to turn the RAID system off, you must go through a regular shutdown procedure. Always follow the steps below to instruct the controller restart or halt before powering off the RAID system.

1. Select **System Management > Restart/Halt** from the main menu.
2. Select **Restart** or **Halt** from the drop-down menu.
3. Click **Apply**.
 - When **Restart** is selected, the controller automatically restarts. Click **Reconnect** when boot up is complete.
 - When **Halt** is selected, a confirmation prompt displays. Click **Confirm**, close the GUI, and power off the RAID system.

2.10.10 Miscellaneous

Select **System Management > Miscellaneous** from the main menu, and the following settings become available for your controller.

Enclosure Polling Period (second): Disabled (default)/1/2/5/10/30/60

(This option is only available for the controller equipped with an expansion port.)

By specifying the polling interval, the controller polls the external enclosure to acquire its status periodically. When disabled, the controller cannot obtain the status of the enclosures.

Enclosure Disk Polling Period (second): Disabled (default)/1/2/5/10/30

(This option is only available for the controller equipped with an expansion port.)

By specifying the disk polling interval, the controller polls the hard disks in the external enclosure to acquire its status periodically. When disabled, the controller cannot obtain the hard disk status of the enclosures.

GUI Refresh Rate (second): 5 (default)

By default, the GUI refreshes itself every 5 seconds. You can specify a new refresh rate. The range is from 2 to 15.



Note

Faster GUI refresh rates may degrade the performance of controller.

To make the settings effective, click **Apply**.

2.11 Performance Management

2.11.1 Hard disks

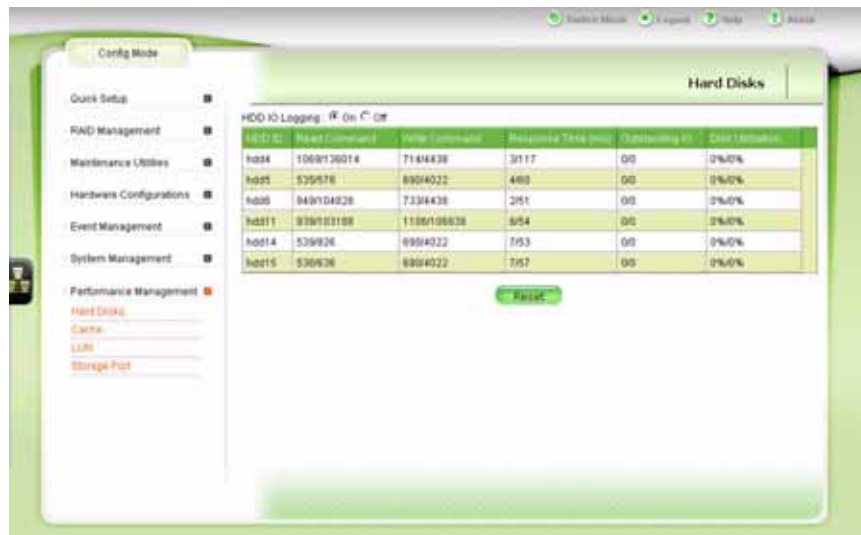


Figure 2-22 Hard Disks screen (Performance Management menu)

This feature allows you to enable, disable, or reset hard disk IO logging for all hard disks.

When hard disk IO logging is enabled, the following data will be displayed. You can press the **Reset** button to clear all statistics except outstanding IO and disk utilization to zero.

Category	Display
HDD ID	Hard disk identifier
Read Command (sector)	The number of read commands executed since the disk was powered on
	The accumulated transfer size of read commands since the disk was powered on
Write Command (sector)	The number of write commands executed since the disk was powered on
	The accumulated transfer size of write commands since the disk was powered on
Response Time (ms)	The average command response time since the disk was powered on
	The maximum command response time since the disk was powered on

Outstanding IO	The number of current outstanding IO in the disk
	The number of current outstanding IO in the controller's IO scheduler queue
Disk Utilization	The disk utilization in the last second
	The disk utilization in the last five seconds

2.11.2 Cache

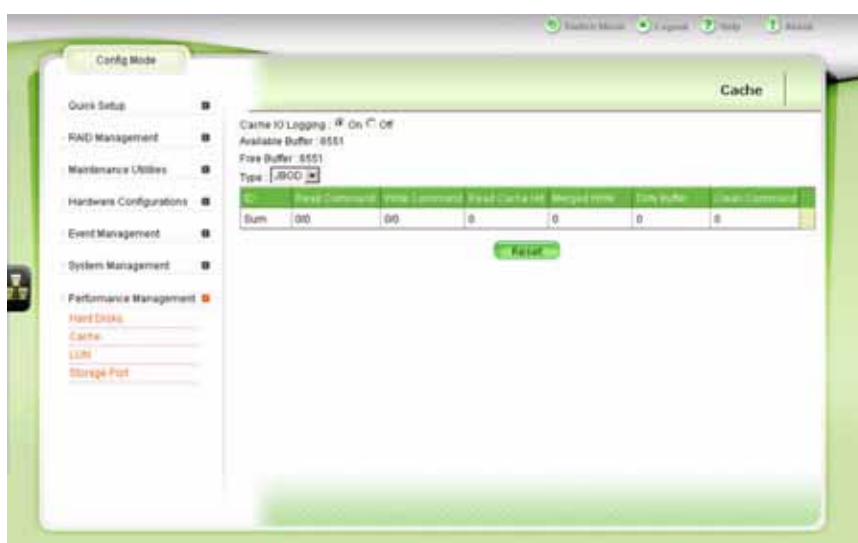


Figure 2-23 Cache screen (Performance Management menu)

This feature allows you to enable, disable, or reset buffer cache IO logging.

When cache IO logging is enabled, select the cache type (volume, logical disk, or JBOD disk) to be displayed from the drop-down menu. The following IO statistics will be displayed. You can press the **Reset** button to clear all statistics except dirty buffer and clean buffer to zero.

Category	Display
ID	Cache identifier
Read Command (sector)	The number of read commands executed since the disk was powered on
	The accumulated transfer size of read commands since the disk was powered on
Write Command (sector)	The number of write commands executed since the disk was powered on
	The accumulated transfer size of write commands since the disk was powered on

Read Cache Hit	The number of cache hits by read commands since the system was powered on
Merged Write	The number of merged writes (write hits) since the system was powered on
Dirty Buffer	The number of dirty buffers in the cache at present
Clean Buffer	The number of clean buffers in the cache at present

2.11.3 LUN

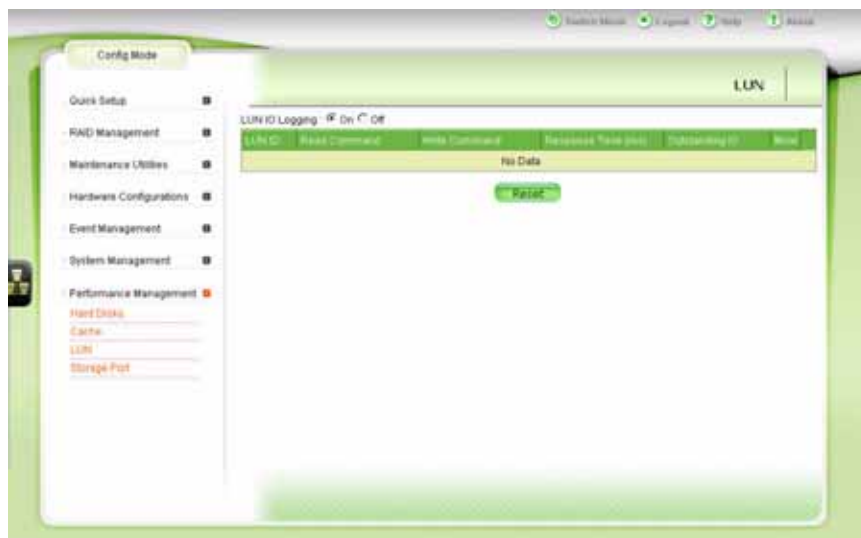


Figure 2-24 LUN screen (Performance Management menu)

This feature allows you to enable, disable, or reset LUN IO logging.

When LUN IO logging is enabled, the following IO statistics of a LUN (depending on the storage presentation method selected) will be displayed. You can press the **Reset** button to clear all statistics except outstanding IO to zero.

Using the RAID GUI

Category	Display
ID	Storage group and LUN identifier
Read Command (sector)	The number of read commands executed since the disk was powered on
	The accumulated transfer size of read commands since the disk was powered on
Write Command (sector)	The number of write commands executed since the disk was powered on
	The accumulated transfer size of write commands since the disk was powered on
Response Time (ms)	The average command response time since the disk was powered on
	The maximum command response time since the disk was powered on
Outstanding IO	The number of current outstanding IO

Click  to see a complete list of LUN information. You will see the specified LUN ID and its histogram output in the following sectors. The histogram output shows the sizes that the read and write commands return.

- LUN ID
- 1 Sector
- 2 Sector
- 4 Sector
- 8 Sector
- 16 Sector
- 32 Sector
- 64 Sector
- 128 Sector
- 256 Sector
- 512 Sector

2.11.4 Storage port

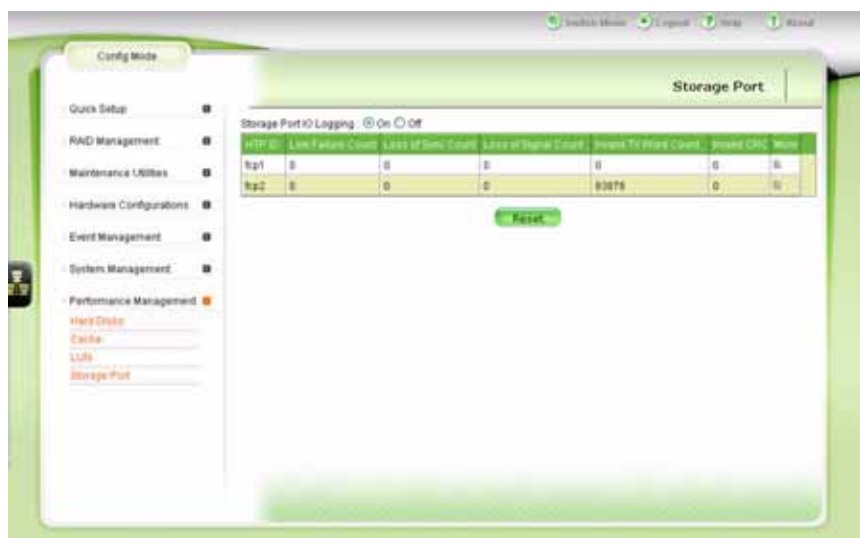


Figure 2-25 Storage Port screen (Performance Management menu)

This feature allows you to enable, disable, or reset storage port IO logging.

When storage port IO logging is enabled, the following statistics of a FC ports or SAS port will be displayed. You can press the **Reset** button to clear all statistics to zero.

Category	Display
HTP ID	FC port identifier
Link Failure Count	The value of the LINK FAILURE COUNT field of the Link Error Status Block for the port
Loss of Sync Count	The value of the LOSS-OF-SYNCHRONIZATION COUNT field of the Link Error Status Block for the port
Loss of Signal Count	The value of the LOSS-OF-SIGNAL COUNT field of the Link Error Status Block for the port
Invalid TX Word Count	The value of the INVALID TRANSMISSION WORD field of the Link Error Status Block for the port
Invalid CRC Count	The value of the INVALID CRC COUNT field of the Link Error Status Block for the port

Click  to see a complete list of storage port information. You will see the following details.

- HTP ID
- Primitives Sequence Protocol Error Count
- Second since last reset
- TX/RX Frame
- TX/RX Word
- LIP Count
- NOS Count
- Error Frame
- Dumped Frame



Note

The information displayed is dependent on the installed FC chip. Some chips do not support the provision of all storage port information.

Chapter 3: Using the LCD Console

3.1 Starting LCD Manipulation

The RAID system has a front LCD panel which supports a quick configuration and RAID monitoring. You can use the four buttons on the LCD panel to manipulate the LCD configuration utility. Each state and display sequence is illustrated as below:

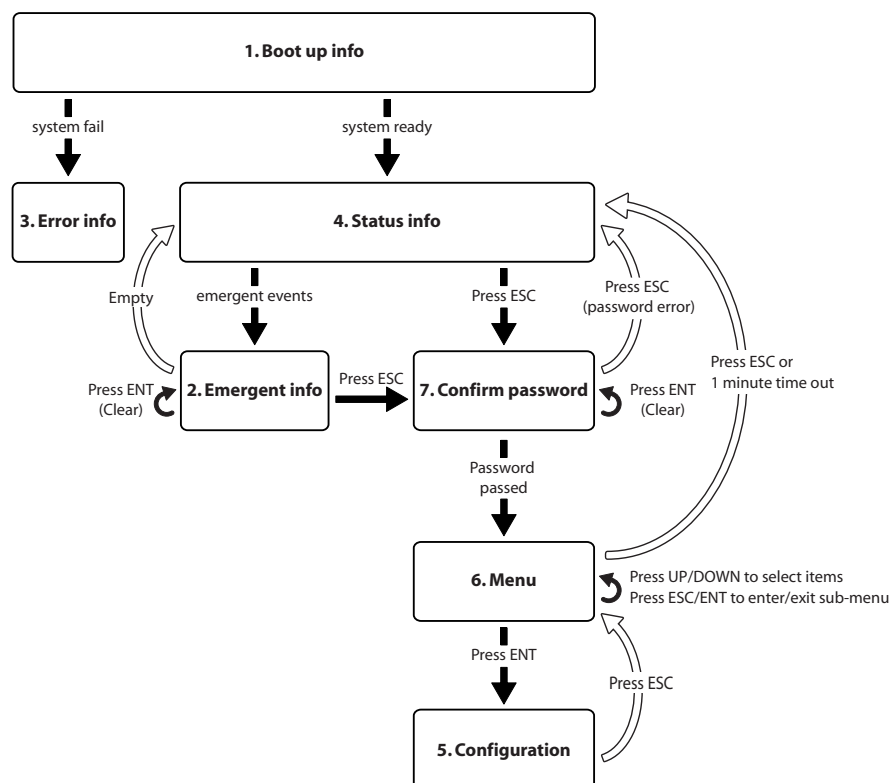


Figure 3-1 LCD manipulation procedure

Once the RAID system is powered on, the booting information starts to display on the LCD panel. If the system is ready, status messages are displayed sequentially. If not, error messages are displayed and the system is halted. See the details of status and emergent messages in the following section **3.2 LCD Messages**.

3.1.1 Confirm password

To enter the menu, a password may be required depending on your settings. The default password is "0000". Use the buttons for password input. See the use of buttons as below.

UP/DOWN: Select the numbers 0 to 9, characters "a" to "z".

ENT: Enter the selected character, or confirm the password if no character is selected.

ESC: Backspace, or go back to the status info if password is empty.

3.2 LCD Messages

3.2.1 LCD layout

{INFO1}	*
{INFO2/DISK}	

Where:

* : Heart Plus. The heart plus icon flashes when the controller is working normally. When not flashing, this indicates a controller failure has occurred.

INFO1: Information (including status info, emergent info, and background task messages) display area at line 1, the maximum string length is 15.

INFO2: Information display area at line 2, the maximum string length is 16.

DISK: Disk status display area at line 2. The format is "xxxxxxxxxxxxxxxxxxxx".

Each "a" is the HDD status, which are represented as following:

{1, 2, ..., 7}: Disk group number

?: Unknown error

A: Adding disk

B: Faulty disk

C: Clone-target disk

F: Foreign disk

G: Global spare disk

I: Initializing

J: JBOD disk

L: Local spare disk

N: Foreign/ Conflict disk

S: Local spare disk

T: Clone-target disk

U: Unused disk

W: SMART warning or BBR alert

X: No disk

INFO2 and **DISK** are mutual exclusive.

3.2.2 Status info

When the system is ready, the system information and background task messages are displayed sequentially every two seconds. See the button functions as below.

UP/DOWN: Scroll up/down the message.

ESC: Clear the message and enter the menu (password may be required).

ENT: Enter the password (if required).

UP+DOWN: Clear all status info and restart to display all the status messages.

Line 1 shows messages, and Line 2 shows the disk status. Messages to be displayed on the LCD panel can be customized by users. The supported status info is listed below:

Table 3-1 List of status messages

Status Info	Message	Note
Product name	product name	
Expansion name	Expansion #x	#x: Expansion ID Up to four expansions can be added.
Date and time	hh:mm MM/DD YY	
IP address	xxx.xxx.xxx.xxx	
BP FAN[x] rpm	BP_FANx xxxxxrpm	
Expansion FAN[x] rpm	FAN#x xxxxxrpm	
Controller voltage +3.3V	CTL3.3V: xx.xx	3.3V, 5V, and 12V status on controller
Controller voltage +5V	CTL5.0V: xx.xx	
Controller voltage +12V	CTL12.0: xx.xx	
BP voltage +3.3V	BP3.3V: xx.xx	3.3V, 5V, and 12V status on backplane
BP voltage +5V	BP5.0V: xx.xx	
BP voltage +12V	BP12.0: xx.xx	
Expansion voltage sensor[x]	Volt#x: xx.xx	

Table 3-1 List of status messages

Status Info	Message	Note
Controller temperature sensor[x]	CTL_TEMPx: xx.xC	Both Celsius (C) and Fahrenheit (F) are supported. Users can customize the temperature scale for the display.
BP temperature sensor[x]	BP_TEMPx: xx.xC	
BP average temperature	BP_AVG: xx.xC	
Expansion temperature sensor[x]	TEMP#x: xx.xC	
Power[x] is %s	Powx: %s	%s: Good, Warning, Error, OFF
Expansion power[x] is %s	Pow#x: %s	

3.2.3 Emergent info

When an emergent event occurs, you can read the message on the LCD. This state is held until every event is confirmed. See the function buttons as below.

UP/DOWN: Scroll up/down the message.

ENT: Confirm (clear) the message. (not supported in current version.)

ESC: Enter the menu (password may be required).

Line 1 shows messages, and Line 2 shows the disk status. The displayed emergent info is listed below:

Table 3-2 List of emergent messages

Emergent Info	Message	Note
Voltage failure	Voltage Failure	
Power failure	Power Failure	
Fan failure	Fan Failure	
Temperature sensor failure	Temp Failure	Temperature warning is not included.
BBM failure	BBM Failure	Only when BBM is present.
Disk SMART warning	SMART Warning	
Disk BBR error	Disk BBR Error	
DG with degraded LD and no rebuild task	DG+Degraded LD	
DG with faulty LD	DG+Faulty LD	
UPS On Batt	UPS On Batt	Only when upsconfig is on.
UPS connection is lost	UPS Con Lost	Only when upsconfig is on.
UPS should be replaced	UPS RB	Only when upsconfig is on.
UPS is overload	UPS Overload	Only when upsconfig is on.
UPS is off	UPS Off	Only when upsconfig is on.

3.2.4 Background task messages

Background tasks and their process percentages are displayed in Line 1. Line 2 shows the disk status. Message formats are listed in the following.

Variables:

xx.yy : xx is the DG identifier; yy is the LD identifier.

dgx : DG identifier.

zz / HDD z : HDD identifier.

xx.x% : The progress of task (with percentage estimate)

Table 3-3 List of background task messages

Background Task	Message Format
LD Expand	xx.yy Exp xx.x%
LD Migrate	xx.yy Mig xx.x%
DG Defragment	dgx Defrg xx.x%
DG Expanding	dgx Exp xx.x%
Disk Cloning	Clone zz xx.x%
Disk Initializing	xx.yy Ini xx.x%
Disk Rebuilding	Reb xx xx.x%
Disk (HDD) Scrubbing	Scrub zz xx.x%
LD Scrubbing	xx.yy Scr xx.x%
DG Scrubbing	dgx Scr xx.x%
Regenerate LD Parity	xx.yy Par xx.x%
Regenerate DG Parity	dgx Par xx.x%

3.2.5 Hotkeys

There are four buttons on the LCD console, UP, DOWN, ESC, and ENT. In addition to their basic functions, they can be used in combination for certain hotkey functions.

Hotkey / Key Combinations	Description
UP	View the previous status info message.
DOWN	View the next status info message.
ESC	Enter the menu mode.
UP+DOWN	Press twice to mute the beeper.
ESC+ENT	Restart to display the local enclosure status info messages.
ENT+UP	Display the previous expansion info message.
ENT+DOWN	Display the next expansion info message.

3.3 Menu

3.3.1 Menu Tree

Use the **UP** or **DOWN** arrow buttons to scroll through the menu. Press the **ENT** button to enter the selected setting. To exit the menu, press **ESC**. The menu tree hierarchy is as shown below:

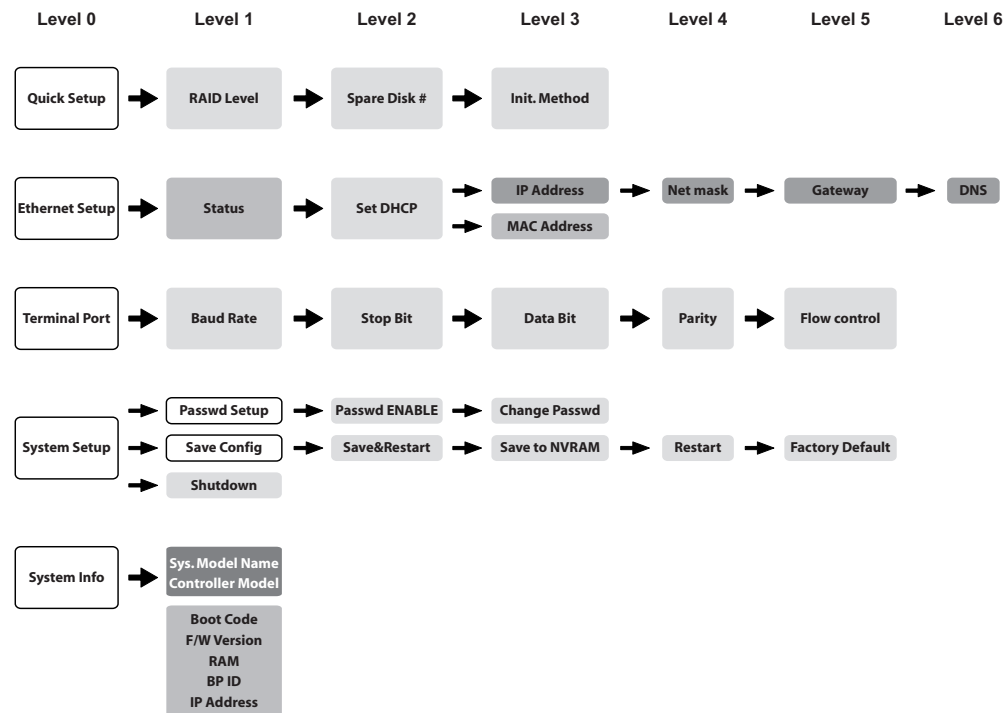


Figure 3-2 Menu tree

3.3.2 Creating an Array

In the **Quick Setup** menu, users can create disk arrays quickly and easily. Configure the following items to create the array. See the options as below.

RAID Level	Level 0 (default), Level 3, Level 5, Level 6, Level 10, Level 30, Level 50, Level 60
Spare Disk #	Default, 1, 2, 3, 4
Init. Method	Background, Foreground (default), No Init

Use the **UP** and **DOWN** buttons to scroll through the options. Press the **ENT** button to select. To cancel the selection and return to the previous level, press the **ESC** button.

3.3.3 Network Settings

In **Ethernet Setup** menu, users can view the network status and configure the server settings. Use the **UP** and **DOWN** buttons to scroll through the following items, and press the **ENT** button to select.

Status	Displays the connection status.
Set DHCP	ENABLE (default) / DISABLE If DHCP is disabled, the system will require you to enter an IP address, net mask, gateway, and DNS. These settings are configured in the sequence as shown.
MAC Address	Display MAC address.

Users can enter the IP related settings according to the following IP format.

IP format: "xxx.xxx.xxx.xxx", where x is {0, 1, ..., 9}.

Use the **UP** and **DOWN** buttons to select the numbers 0 to 9. Press the **ENT** button to enter the number. To cancel the selection, backspace, and return to the previous level (if IP is empty), press the **ESC** button.

3.3.4 Terminal Port Settings

To configure the settings of terminal port, enter the **Terminal Port** menu. Specify the following items one by one.

Baud Rate	2400, 4800, 9600, 19200, 38400, 57600, 115200 (default)
Stop Bit	1 (default), 2
Data Bit	7, 8 (default)
Parity	NONE (default), ODD, EVEN
Flow control	OFF (default), H/W

Use the **UP** and **DOWN** buttons to scroll through the options. Press the **ENT** button to select it. To cancel the selection and return to the previous level, press the **ESC** button.

3.3.5 System Settings

In the **System Setup** menu, users are allowed to change the password settings, save or restore the configurations to NVRAM, reboot and power off the system. See the following table for details of each option.

Password	Passwd ENABLE: YES (default) / NO Enable or disable the password check when logging in menu. Change Passwd Key in the new password. The maximum length of password is eight characters. Press and hold the ESC button to backspace continuously and return to the previous level.
Save Config	Save to NVRAM: NO (default) / YES Save configurations to NVRAM. Restart: NO (default) / YES Reboot the system. Factory: NO (default) / YES Restore the factory settings to NVRAM.
Shutdown	NO (default) / YES Power off the system.

Use the **UP** and **DOWN** buttons to scroll through the items and options. Press the **ENT** button to select. To cancel the selection and return to the previous level, press the **ESC** button.

3.3.6 System Information

The **System Info** menu provides the following information. Use the **UP** and **DOWN** buttons to scroll through each of them. Users are allowed to modify the model name of the system and controller.

Sys. Model Name	Display and modify system model name.
Controller Model	Display and modify controller model name.
Boot Code	Display boot code version.
F/W Version	Display firmware version.
RAM	Display system memory size.
BP ID	Displays Backplane ID number.
IP Address	Displays controller IP address

Chapter 4: Using the CLI Commands

4.1 Overview

The Command Line Interface (CLI) is a set of commands which allows users to configure the RAID system by entering lines of text through the following consoles:

- Telnet
- SSH
- RS232 Terminal

Log in to the console using **admin** as the username and **0000** as the password.

4.1.1 Conventions Overview

Object names

Storage objects are named using the following keywords with an identifier (**x**):

- Hard disk: **hddx**
- JBOD disk: **jbdx**
- Disk group: **dgx**
- Logical disk: **dgxldy**
- Volume: **volx**
- Host: **hostx**
- Storage group: **sgx**
- Host group: **hgx**
- Logical unit: **lunx**
- Fiber port: **fcpx**
- Serial SCSI port: **sasx**
- Controller: **ctlx**
- Management network port: **ethx**
- Enclosure: **encx**

Options

Options are expressed in the form of **[-x ...]**, where **-x** is the identifier of the option.

Selectable arguments

Using the CLI Commands

When more than one value can be used in an argument, they are listed with “/” in between. Users may choose one among them.

See all the CLI commands and the descriptions in the following sections.

4.2 Basic RAID Management

4.2.1 Hard disks

Command	hddadd
Synopsis	hddadd hddx hddy ...
Description	Add hard disks.

Command	hddremove
Synopsis	hddremove hddx hddy ...[-p]
Description	Remove hard disks.
Parameters	[-p]: permanent remove

Command	hddlist
Synopsis	hddlist hddx/all [-h]
Description	List the status of one or all hard disks.
Parameters	[-h]: show hardware status

4.2.2 JBOD disks

Command	jbdcreate
Synopsis	jbdcreate jbdx hddy [-n <i>name</i>] [-c ctlx]
Description	Create a JBOD disk by a member disk.
Parameters	[-n <i>name</i>]: the name of a JBOD disk

Command	jbddelete
Synopsis	jbddelete jbdx [-f]
Description	Delete a JBOD disk.
Parameters	[-f]: force to delete LUN mapping

Command	jbdname
Synopsis	jbdname jbdx <i>name</i>
Description	Name a JBOD.

Command	jbdlist
Synopsis	jbdlist jbdx/all
Description	List the status of one or all JBOD disks.

4.2.3 Disk groups

Command	dgcreate
Synopsis	dgcreate dg <i>i</i> hdd <i>x</i> hdd <i>y</i> ... [-n name] [-i par/seq] [-z] [-c ctl <i>x</i>] [-s hdd <i>z</i> ,hdd <i>a</i> , ...] [-t capacity]
Description	Create a disk group with member disks.
Parameters	[-n name]: the name of a disk group [-i par/seq]: logical disk initialization mode (parallel or sequential) [-z]: write-zero immediately [-s hdd <i>z</i> ,hdd <i>a</i> , ...]: local spare disks [-t capacity]: capacity to truncate

Command	dgdelete
Synopsis	dgdelete dg <i>i</i>
Description	Delete a disk group.

Command	dgname
Synopsis	dgname dg <i>x</i> name
Description	Name a disk group.

Command	dginit
Synopsis	dginit dg <i>i</i> par/seq
Description	Set initiation mode of a disk group.

Command	dglist
Synopsis	dglist dg <i>x</i> /all
Description	List the status of one or all disk groups.

4.2.4 Spare and rebuild

Command	dgspare
Synopsis	dgspare add/remove dgi hddx
Description	Add or remove a local spare in a disk group.

Command	dgrebseq
Synopsis	dgrebseq dgi par/seq/pri [-l ldx,ldy, ...]
Description	Set rebuild mode of a disk group.
Parameters	par/seq/pri: parallel, sequential, or priority [-l ldx,ldy, ...]: priority of logical disks to rebuild

Command	globalspare
Synopsis	globalspare add/remove hddx hddy ...
Description	Add or remove one or more hard disks as global spare disks.

Command	autospare
Synopsis	autospare [on/off]
Description	Review or set the auto spare settings.
Parameters	[on/off]: turn on or off the auto spare option

Command	restorespare
Synopsis	restorespare [on/off]
Description	Review or set the restore spare settings.
Parameters	[on/off]: turn on or off the restore spare option

4.2.5 Logical disks

Command	ldcreate
Synopsis	ldcreate dgxldy capacity raidlevel [-s stripesize] [-i initopt] [-f x] [-o offset] [-n name]
Description	Create a logical disk.
Parameters	capacity : logical disk capacity raidlevel : raid0, raid5, raid3, raid1, raid6, raid10, or nraid [-s stripesize]: stripe size [-i initopt]: initialization method [-f x]: free chunk [-o sector]: alignment offset [-n name]: the name of a logical disk

Command	lddelete
Synopsis	lddelete dgxldy [-f]
Description	Delete a logical disk.
Parameters	[-f]: force to delete LUN mapping

Command	ldname
Synopsis	ldname dgxldy name
Description	Name a logical disk.

Command	ldlist
Synopsis	ldlist dgxldy/dgx/all
Description	List the status of one logical disk, all logical disks on a disk group, or all logical disks on the controller.

4.2.6 RAID algorithms options

Command	intellicompute
Synopsis	intellicompute dg ~~x~~ ld ~~y~~ /all on/off
Description	Enable or disable Intelligent data computation for one or all RAID 3/5/6 logical disks.

Command	readmaxtime
Synopsis	readmaxtime dg ~~x~~ ld ~~y~~ /all ~~xx~~ msec
Description	Specify the maximum response time for one or all RAID 3/5/6 logical disks.

Command	checkonread
Synopsis	checkonread dg ~~x~~ ld ~~y~~ /all on/off
Description	Enable or disable check-on-read for all RAID 3/5/6 logical disks.

Command	writelog
Synopsis	writelog [on/off]
Description	Review or set the write logging.
Parameters	[on/off]: enable or disable write logging

4.2.7 Volumes

Command	volcreate
Synopsis	volcreate vol x dg x ld y dg l ld j ...[-s <i>stripesize</i>] [-o <i>sector</i>] [-n <i>name</i>]
Description	Create a volume.
Parameters	[-s <i>stripesize</i>]: stripe size [-o <i>sector</i>]: alignment offset [-n <i>name</i>]: the name of a volume
Command	voldelete
Synopsis	voldelete vol x [-f]
Description	Delete a volume.
Parameters	[-f]: force to delete LUN mapping
Command	volname
Synopsis	volname vol x <i>name</i>
Description	Name a volume.
Command	vollist
Synopsis	vollist vol x /all
Description	List the status of one or all volumes.

4.2.8 Cache

Command	readahead
Synopsis	readahead volx/dgxldy/jbdx/all policy [-m multiplier] [-l read_log]
Description	Enable or disable read ahead policy of a volume, a logical disk, a JBOD disk, or all virtual disks.
Parameters	policy : always, adaptive, or off [-m multiplier]: set read-ahead multiplier [-l read_log]: set number of read logs

Command	writecache
Synopsis	writecache volx/dgxldy/jbdx/all on/off [-s on/off]
Description	Enable or disable write cache of a volume, a logical disk, a JBOD disk, or all buffers.
Parameters	[-s on/off]: enable or disable the write sorting

Command	cachepflush
Synopsis	cachepflush [periodsec]
Description	Review or set the current cache flush period.
Parameters	[periodsec]: the cache flush period

Command	cacheunit
Synopsis	cacheunit [4kb/8kb/16kb/32kb/64kb/128kb]
Description	Review or set the cache unit size.
Parameters	[4kb/8kb/16kb/32kb/64kb/128kb]: set cache unit size

Command	cacheflush
Synopsis	cacheflush volx/dgxldy/jbdx/all [-w xxmin]
Description	Flush write buffers in the write cache of a volume, a logical disk, a JBOD disk, or all write buffers in the cache.
Parameters	[-w xxmin]: number of minutes to wait for flush completion

Using the CLI Commands

Command	cachedirtyratio
Synopsis	cachedirtyratio [<i>dirty_ratio</i>]
Description	Review or set the dirty buffer ratio.
Parameters	[<i>dirty_ratio</i>]: dirty buffer ratio

Command	cachelist
Synopsis	cachelist vol <i>x</i> /dg <i>x</i> ldy/jbd <i>x</i> /all
Description	List the setting and status of a volume, a logical disk, a JBOD disk.

4.3 RAID Maintenance Utilities

4.3.1 RAID attributes reconfiguration utilities

Command	dgexpand
Synopsis	dgexpand dg <i>i</i> [-d] hdd <i>x</i> hdd <i>y</i> ...
Description	Expand a disk group by adding one or more disks.
Parameters	[-d]: defragment during expanding

Command	ldmigrate
Synopsis	ldmigrate dg <i>xldy</i> [-s <i>newstripe</i> size] [-r <i>newraid</i> level] [-d] [-l hdd <i>x</i> ,hdd <i>y</i> ,...]
Description	Perform RAID level and/or stripe size migration for a logical disk on a disk group. At least one option must be set.
Parameters	[-s <i>newstripe</i> size]: migrate to new stripe size [-r <i>newraid</i> level]: migrate to new RAID level [-d]: defragment during migration [-l hdd <i>x</i> ,hdd <i>y</i> ,...]: expanding disk group by adding these hard disks

Command	ldexpand
Synopsis	ldexpand dg <i>ildx</i> <i>newcapacity</i> [-i <i>initopt</i>] [-f <i>x,y</i>]
Description	Expand the capacity of one or more logical disks in a disk group.
Parameters	<i>newcapacity</i> : new capacity of a logical disk [-i <i>initopt</i>]: initialization method [-f <i>x,y</i>]: free chunks

Command	ldshrink
Synopsis	ldshrink dg <i>ildx</i> <i>newcapacity</i>
Description	Shrink the capacity of a logical disk.
Parameters	<i>newcapacity</i> : new capacity of a logical disk

Using the CLI Commands

Command	dgdefrag
Synopsis	dgdefrag <i>dg<i>i</i></i>
Description	Defragment a disk group.

Command	volexpand
Synopsis	volexpand <i>vol<i>x</i></i> <i>dg<i>i</i>ld<i>x</i></i> <i>dg<i>j</i>ld<i>y</i></i>
Description	Expand a volume by concatenating new logical disks.

Command	volshrink
Synopsis	volshrink <i>vol<i>x</i></i>
Description	Shrink the capacity of a volume by removing the concatenating logical disks.

4.3.2 Data integrity maintenance utilities

Command	ldexpand
Synopsis	ldexpand dg $\bar{i}$ ld $\bar{x}$ <i>newcapacity</i> [-i <i>initopt</i>] [-f <i>x,y</i>]
Description	Expand the capacity of one or more logical disks in a disk group.
Parameters	<i>newcapacity</i> : new capacity of a logical disk [-i <i>initopt</i>]: initialization method [-f <i>x,y</i>]: free chunks

Command	hddclone
Synopsis	hddclone hdd $\bar{x}$ hdd $\bar{y}$ [-a]
Description	Perform disk cloning (clone from hdd $\bar{x}$ to hdd $\bar{y}$).
Parameters	[-a]: automatic resume

Command	hddclonestop
Synopsis	hddclonestop hdd $\bar{x}$
Description	Stop disk cloning.

Command	diskscrub
Synopsis	diskscrub dg $\bar{x}$ /dg $\bar{x}$ ld $\bar{y}$ /hdd $\bar{x}$ [-c] [-g]
Description	Perform disk scrubbing in a disk group, a logical disk, or a hard disk.
Parameters	[-c]: parity check [-g]: regenerate

Command	diskscrubstop
Synopsis	diskscrubstop dg $\bar{x}$ /dg $\bar{x}$ ld $\bar{y}$ /hdd $\bar{x}$
Description	Stop disk scrubbing in a disk group, a logical disk, or a hard disk.

Command	regparity
Synopsis	regparity dg $\bar{x}$ /dg $\bar{x}$ ld $\bar{y}$
Description	Regenerate the parity of a logical disk or the logical disks of disk group with parity-based RAID level.

Using the CLI Commands

Command	regparitystop
Synopsis	regparitystop dg ~~x~~ ldy/dgx
Description	Stop regenerating parity of a logical disk or the logical disks of disk group with parity-based RAID level.

4.3.3 Task priority contro

Command	hddutilpri
Synopsis	hddutilpri [<i>priority</i>]
Description	Show or set the utilities task priority of non-DG hard disks.
Parameters	[<i>priority</i>]: low, medium, or high

Command	dgrebpri
Synopsis	dgrebpri dgx <i>priority</i>
Description	Set the rebuild task priority of a disk group.
Parameters	<i>priority</i> : low, medium, or high

Command	dginitpri
Synopsis	dginitpri dgx <i>priority</i>
Description	Set the initialization task priority of a disk group.
Parameters	<i>priority</i> : low, medium, or high

Command	dgutilpri
Synopsis	dgutilpri dgx <i>priority</i>
Description	Set the utilities task priority of a disk group.
Parameters	<i>priority</i> : low, medium, or high

4.3.4 Task schedule management

Command	<code>scheduledcreate</code>
Synopsis	<code>scheduledcreate [-s <i>YYYY/MM/DD/hh/mm</i>]/[-m <i>DD/hh/mm</i>]/[-w <i>WD/hh/mm</i>] <i>command</i></code>
Description	Create a schedule or a periodic schedule for a CLI command.
Parameters	<code>[-s <i>YYYY/MM/DD/hh/mm</i>]</code>: the target date/time <code>[-m <i>DD/hh/mm</i>]</code>: monthly <code>[-w <i>WD/hh/mm</i>]</code>: weekly <i>command</i>: commands allowed to be scheduled include <i>dgexpand</i>, <i>dgdefrag</i>, <i>ldmigrate</i>, <i>ldexpand</i>, <i>hddclone</i>, <i>diskcrub</i>, <i>regparity</i> and <i>hdddst</i>

Command	<code>scheduleddelete</code>
Synopsis	<code>scheduleddelete <i>schedule_id</i></code>
Description	Delete a schedule with the schedule ID.

Command	<code>schedulelist</code>
Synopsis	<code>schedulelist <i>command</i>/all</code>
Description	List one or all types of scheduled commands.

4.3.5 On-going task monitoring

Command	<code>tasklist</code>
Synopsis	<code>tasklist <i>command</i>/all</code>
Description	List one or all types of background tasks.

Command	<code>tasknotify</code>
Synopsis	<code>tasknotify on/off [-p <i>percentage</i>]</code>
Description	Enable or disable the event notification of the background task completion.
Parameters	<code>[-p <i>percentage</i>]</code> : completion percentage to notify

4.3.6 Array and volume roaming

Command	autoroam
Synopsis	autoroam on/off
Description	Enable or disable automatic array roaming when the controller is started.

Command	onlineroam
Synopsis	onlineroam on/off
Description	Enable or disable on-line array roaming.

Command	hddimport
Synopsis	hddimport [-f][-t jbdx/dgx] all/hddx hddy hddz ...
Description	Import all or specified foreign/conflict hard disks.
Parameters	[-f]: force to import an incomplete disk group with degraded logical disks [-t jbdx/dgx]: target disk to restore

Command	hddimportlist
Synopsis	hddimportlist all/hddx hddy hddz ...
Description	List all or specified foreign/conflict hard disks with the configurations stored on the hard disks.

Command	volimport
Synopsis	volimport [-f][-t volx] dgxldy dgildj ...
Description	import a volume from logical disks specified.
Parameters	[-f]: force to import a faulty volume [-t volx]: target volume

Command	volimportlist
Synopsis	volimportlist all/dgx dgy ...
Description	List volume configurations on all or specified logical disks.

4.3.7 Array recovery utilities

Command	dgrecover
Synopsis	dgrecover dg x hdd x hdd y ... [-f <i>member_id</i>]
Description	Recover a faulty disk group.
Parameters	[-f <i>member_id</i>]: force to recover disk

Command	ldrecover
Synopsis	ldrecover dg x ld y <i>partition_id</i>
Description	Recover a faulty logical disk.

Command	volrecover
Synopsis	volrecover vol x dg i ld j dg x ld y ...
Description	Recover a faulty volume.

4.4 Storage Presentation

4.4.1 Hosts

Command	hostcreate
Synopsis	hostcreate hostx <i>WWN</i> [-n <i>name</i>]
Description	Create a host with WWN.
Parameters	[-n <i>name</i>]: host name

Command	hostdelete
Synopsis	hostdelete hostx hosty ...
Description	Delete hosts.

Command	hostname
Synopsis	hostname hostx <i>name</i>
Description	Name a host.

Command	hostlist
Synopsis	hostlist all/hostx
Description	List all hosts or one host.

4.4.2 Host groups

Command	hgaddhost
Synopsis	hgaddhost <i>hg</i> x <i>host</i> x <i>host</i> y ...
Description	Add hosts to a host group.

Command	hgremovehost
Synopsis	hgremovehost <i>hg</i> x <i>host</i> x <i>host</i> y ...
Description	Remove hosts from a host group.

Command	hgname
Synopsis	hgname <i>hg</i> x <i>name</i>
Description	Name a host group.

Command	hglist
Synopsis	hglist <i>hg</i> x /all
Description	List one or all host groups.

4.4.3 Storage groups

Command	sgaddlun
Synopsis	sgaddlun sgx/fcpx/sasx/scpx jbdy/dgyldz/voly/vvoly [-l lunz] [-s 512b/1kb/2kb/4kb] [-g cylinder head sector] [-w wt/wb]
Description	Add a LUN in a storage group or a default storage group.
Parameters	[-l lunz]: LUN to be used by the virtual disk [-s 512b/1kb/2kb/4kb]: set sector size [-g cylinder head sector]: set the cylinder/head/sector mapping of the LUN [-w wt/wb]: write completion (write-through or write-behind)
Command	sgremovelun
Synopsis	sgremovelun sgx/fcpx/sasx/scpx luny/all
Description	Remove one or all LUNs in a storage group or a default storage group.
Command	sgremovedisk
Synopsis	sgremovedisk sgx/fcpx/sasx/scpx/all jbdy/dgyldz/voly/vvoly
Description	Remove LUNs of a virtual disk from one storage groups, a default storage group, or all storage groups.
Command	sgmasklun
Synopsis	sgmasklun sgx/fcpx/sasx luny/all
Description	Mask one or all LUNs in a storage group or a default storage group.
Command	sgunmasklun
Synopsis	sgunmasklun sgx/fcpx/sasx luny/all
Description	Unmask one or all LUNs in a storage group or a default storage group.

Command	sgaccess
Synopsis	sgaccess sgx/fcpx/sasx/scpx all/luny ro/rw
Description	Set LUN access right of one or all LUNs in a storage group or a default storage group.
Parameters	ro/rw: read-only or read-writable

Command	sgname
Synopsis	sgname sgx name
Description	Name a storage group.

Command	sglistlun
Synopsis	sglistlun sgxluny/fcpxluny/sasxluny/scpxluny/sgx/fcpx/sasx/scpx/all
Description	List LUN information in one or all storage groups / default storage groups.

4.4.4 Presentation planning

Command	sgsetmethod
Synopsis	sgsetmethod sim/sym/sel
Description	Select storage presentation method.
Parameters	sim/sym/sel : simple, symmetric-LUN, or selective storage presentation

4.4.5 Selective storage presentation

Command	htpbind
Synopsis	htpbind fcpx/sasx/all sgy hostz/hgz
Description	Bind a storage group to one or all FC ports for a host or a host group.

Command	htpunbind
Synopsis	htpunbind fcpx/sasx/all hostz/hgz
Description	Unbind a host or a host group from one or all FC ports.

Command	htplist
Synopsis	htplist fcpx/sasx/all
Description	List all storage groups bound to one or all FC ports.

4.4.6 Simple storage presentation

Command	htpaddlun
Synopsis	htpaddlun fcp x /sas x jbd y /dgyldz/voly/vvoly [-l lun z] [-s 512b/1kb/2kb/4kb] [-g <i>cylinder head sector</i>] [-w wt/wb] htpaddlun scp x jbd y /dgyldz/voly/vvoly [-i <i>scsi_id</i>] [-l lun z] [-s 512b/1kb/2kb/4kb] [-g <i>cylinder head sector</i>] [-w wt/wb]
Description	Add a LUN in a FC port with a virtual disk.
Parameters	[-i <i>scsi_id</i>]: SCSI ID Refer to sgaddlun for other parameters.

Command	htpremovelun
Synopsis	htpremovelun fcp x /sas x lun y /all htpremovelun scp x id x /idxlun y /all
Description	Remove one or all LUNs in a host port.

Command	htpremovedisk
Synopsis	htpremovedisk fcp x /sas x /scp x /all jbd y /dgyldz/voly/vvoly
Description	Remove all LUNs of a virtual disk from one or all host ports.

Command	htplistlun
Synopsis	htplistlun fcp x /sas x /scp x /all
Description	List LUN information in one or all host ports.

4.4.7 Symmetric-LUN storage presentation

Command	hgaddlun
Synopsis	hgaddlun hg <i>x</i> jbd <i>y</i> / dgyldz / vol <i>y</i> / vvoly [-l lun <i>z</i>] [-s 512b/1kb/2kb/4kb] [-g cylinder head sector] [-w wt/wb]
Description	Add a LUN in a host group with a virtual disk.
Parameters	Refer to sgaddlun for all parameters.

Command	hgreovelun
Synopsis	hgreovelun hg <i>x</i> lun <i>y</i> /all
Description	Remove one or all LUNs from a host group.

Command	hgremovedisk
Synopsis	hgremovedisk hg <i>x</i> /all jbd <i>y</i> / dgyldz / vol <i>y</i> / vvoly
Description	Remove all LUNs of a virtual disk from one or all host groups.

Command	hglistlun
Synopsis	hglistlun hg <i>x</i> /all
Description	List LUN information in one or all host groups.

4.5 Hardware Configurations and Utilities

4.5.1 Generic hard disk

Command	hddst
Synopsis	hddst short/extended all/hddx hddy hddz ...
Description	Perform short or extended disk self test (DST).
Command	hddststop
Synopsis	hddststop all/hddx hddy hddz ...
Description	Stop DST immediately.
Command	hddstlist
Synopsis	hddstlist all/hddx hddy hddz ...
Description	List disk self test information and status.
Command	hddsmart
Synopsis	hddsmart on [-p <i>period</i>] [-a clone/alert] hddsmart off
Description	Change the SMART warning settings of all hard disks.
Parameters	on/off: SMART control [-p <i>period</i>]: period of SMART polling [-a clone/alert]: SMART actions
Command	hddsmartlist
Synopsis	hddsmartlist all/hddx hddy hddz ...
Description	List SMART information and current status of the specified or all hard disks.
Command	hddsmartread
Synopsis	hddsmartread hddx
Description	Display the SMART data of a hard disk.
Command	hddbbralert
Synopsis	hddbbralert on/off [-p <i>percentage1 percentage2 percentage3 percentage4</i>]
Description	Enable or disable event alerts for bad block reallocation.
Parameters	[-p <i>percentage1 percentage2 percentage3 percentage4</i>]: thresholds to alert

Command	hddbbrclone
Synopsis	hddbbrclone on/off [-p <i>percentage</i>]
Description	Enable or disable disk cloning for bad block reallocation.
Parameters	[-p <i>percentage</i>]: thresholds to start cloning

Command	hddbbrretry
Synopsis	hddbbrretry on/off
Description	Enable or disable retrying IO in bad block reallocation.

Command	hddcache
Synopsis	hddcache on/off all/dg <i>x</i> /hdd <i>x</i>
Description	Enable or disable the disk cache of a hard disk, hard disks in a disk group, or all hard disks.

Command	hddstandby
Synopsis	hddstandby on/off
Description	Enable or disable the hard disk standby state.

Command	hddidentify
Synopsis	hddidentify on/off hdd <i>x</i> /dg <i>x</i>
Description	Enable or disable visual identification of a hard disk or disk group.

Command	hddtimeout
Synopsis	hddtimeout <i>xx</i> sec
Description	Specify the timeout value of a IO command sent to hard disks.

Using the CLI Commands

Command	hddretry
Synopsis	hddretry xx
Description	Specify the number of retries when a disk IO command fails.

Command	hddxfermode
Synopsis	hddxfermode mode
Description	Specify the transfer mode of hard disks in the enclosure.

Command	hddqueue
Synopsis	hddqueue on/off
Description	Enable or disable the IO queuing of hard disks.

Command	hdddelayaccess
Synopsis	hdddelayaccess [-b] xxsec
Description	Specify the delay time before the controller tries to access the hard disks after power-on.
Parameters	[-b]: boot-up delay access time

Command	hddverify
Synopsis	hddverify on/off
Description	Enable or disable the write commands for initialization or rebuilding data on logical disks.

Command	hddfwupdate
Synopsis	hddfwupdate hddx firmware.bin
Description	Update the firmware of on-disk controller for a hard disk with the specified firmware file.

Command	hddlistconf
Synopsis	hddlistconf
Description	List the current hardware configurations of all hard disks.

4.5.2 FC ports

Command	fcpname
Synopsis	fcpname fcp <i>x</i> name
Description	Name an FC port.

Command	fcploopid
Synopsis	fcploopid fcp <i>x</i> id /auto
Description	Set the hard loop ID of an FC port.
Parameters	id : hard loop ID auto: automatically determined

Command	fcpconmode
Synopsis	fcpconmode fcp <i>x</i> /all al/fabric/auto
Description	Set the connection mode of an FC port or all FC ports.
Parameters	al/fabric/auto: arbitration loop, fabric, or automatically determined

Command	fcprate
Synopsis	fcprate fcp <i>x</i> /all 1gb/2gb/4gb/auto
Description	Set the preferred data rate of an FC port or all FC ports.

Command	fcplisthost
Synopsis	fcplisthost fcp <i>x</i> /all
Description	List the detected hosts of an FC port or all FC ports.

Command	fcplistusrconf
Synopsis	fcplistusrconf fcp <i>x</i> /all
Description	List the user's configurations of an FC port or all FC ports.

Command	fcplistcurconf
Synopsis	fcplistcurconf fcp <i>x</i> /all
Description	List the current configurations of an FC port or all FC ports.

4.5.3 Management network interface

Command	ethsetaddr
Synopsis	ethsetaddr ethx <i>method</i> [-a] <i>ip_addr</i> [-s] <i>net_mask</i> [-g] <i>gw_addr</i> [-d] <i>dns_addr</i>
Description	Set IP address of an Ethernet port.
Parameters	<i>method</i> : static or dhcp [-a]: network address [-s]: network mask [-g]: gateway address [-d]: DNS server address

Command	ethlistaddr
Synopsis	ethlistaddr ethx
Description	List IP and MAC address of an Ethernet port.

Command	smtpconfig
Synopsis	smtpconfig set primary/secondary <i>server sender</i> [-p <i>password</i>] [-n <i>name</i>] smtpconfig reset primary/secondary
Description	Configure or clear the primary or secondary SMTP servers.
Parameters	set/reset: set or reset SMTP server <i>server</i> : the SMTP server address <i>sender</i> : the account on SMTP server [-p <i>password</i>]: the password of the account on SMTP server [-n <i>name</i>]: name to be shown on the sender field

Command	smtpplist
Synopsis	smtpplist
Description	List the SMTP configurations.

Command	smtptest
Synopsis	smtptest primary/secondary <i>receiver</i>
Description	Send a test mail via primary or secondary mail server to a mail account.
Parameters	<i>receiver</i> : mail address of receiver

Command	ethtelnet
Synopsis	ethtelnet on/off [-p] <i>port_no</i>
Description	Enable or disable the TELNET service on all management network interface ports.
Parameters	<i>port_no</i> : port number

Command	ethweb
Synopsis	ethweb on/off [-p] <i>port_no</i>
Description	Enable or disable the web server on all management network interface ports.
Parameters	<i>port_no</i> : port number

Command	ethapi
Synopsis	ethapi on/off [-p] <i>port_no</i>
Description	Enable or disable the network-based out-band API service on all management network interface ports.
Parameters	<i>port_no</i> : port number

Command	broadcast
Synopsis	broadcast on/off
Description	Enable or disable the controller to respond to the broadcast lookup packets.

Command	ethlist
Synopsis	ethlist
Description	Show the control settings of all management network interface ports.

4.5.4 Local terminal ports

Command	termconf
Synopsis	termconf [<i>baud_rate stop_bit data_bit parity flow_ctrl</i>]
Description	Review or set the terminal.
Parameters	<i>baud_rate</i> : 2400, 4800, 9600, 19200, 38400, 57600, or 115200) <i>stop_bit</i> : 1 or 2 <i>data_bit</i> : 7 or 8 <i>parity</i> : parity check (none, even, or odd) <i>flow_ctrl</i> : flow control (none or hw)

4.5.5 Enclosure

Command	encpoll
Synopsis	encpoll <i>xxsec</i>
Description	Specify the polling interval, at which the controller polls the enclosure controller in the external enclosure to acquire the status of the enclosure.

Command	encdiskpoll
Synopsis	encdiskpoll <i>xxsec</i>
Description	Specify the polling interval, at which the controller polls the disk drives in the external enclosure.

Command	enclist
Synopsis	enclist enc <i>x</i> <i>element</i> /all
Description	List the current status of one or all management elements of an enclosure.
Parameters	<i>element</i> could be one of the following values: spow/vlt/crt/fan/tm. Each of which means power supply, voltage sensor, current sensor, fan, and temperature sensor.

Command	enclist conf
Synopsis	enclistconf
Description	List enclosure configurations.

4.6 Performance management

4.6.1 Hard disks

Command	hddstat
Synopsis	hddstat on/off/reset
Description	Change the setting of hard disk IO logging.

Command	hddliststat
Synopsis	hddliststat hddx
Description	List hard disk IO statistics.

4.6.2 Cache

Command	cachestat
Synopsis	cachestat on/off/reset
Description	Change the setting of cache IO logging.

Command	cachestatlist
Synopsis	cachestatlist volx/dgxldy/jbdx/all
Description	List cache IO statistics.

4.6.3 LUN

Command	lunstat
Synopsis	lunstat on/off/reset
Description	Change the setting of LUN IO logging.

Command	lunliststat
Synopsis	lunliststat sgxluny/fcpxluny/sasxluny/scpxidy/lunz/ hgxly
Description	List LUN IO statistics.

4.6.4 Storage ports

Command	fcpstat
Synopsis	fcpstat on/off/reset
Description	Enable or clear FC port statistics.

Command	fcpliststat
Synopsis	fcpliststat fcp x
Description	List FC port IO statistics.

Command	sasstat
Synopsis	sasstat on/off/reset
Description	Enable or clear SAS port statistics.

Command	sasliststat
Synopsis	sasliststat fcp x
Description	List SAS port IO statistics.

4.7 Event Management

4.7.1 NVRAM event logs

Command	eventlist
Synopsis	eventlist [-f xx] [-n xx] [-s severity]
Description	List records in the event log from older to newer records.
Parameters	[-f xx]: starting point of event to list [-n xx]: maximum number of records to list [-s severity]: severity level of records to list

Command	eventget
Synopsis	eventget log.txt/log.csv
Description	Download all event records to a file, log.txt or log.csv.

Command	eventconfig
Synopsis	eventconfig [-s severity]
Description	List or configure the lowest severity level of events to be recorded.
Parameters	[-s severity]: severity level of events to record

Command	eventerase
Synopsis	eventerase
Description	Erase all records in the event log.

Command	eventtest
Synopsis	eventtest severity
Description	Generate a testing event record with the specified severity level.

4.7.2 Event notification

Command	notifycontrol
Synopsis	notifycontrol on/off smtp/snmp/all
Description	Enable or disable event notifications of all or the selected notification method.

Command	notifylist
Synopsis	notifylist smtp/snmp/all
Description	List the current settings of all or the selected notification method.

Command	eventmailrcv
Synopsis	eventmailrcv set rcvx receiver severity eventmailrcv reset rcvx
Description	Enable or disable the specified mail account for mail notification receiver.
Parameters	set/reset: set or clear receiver rcvx: receiver identifier receiver : mail address of receiver severity : severity level to notify

Command	eventmailconfig
Synopsis	eventmailconfig [-j subject] [-r xmin] [-d xsec] [-c content]
Description	Display or set the event mail configurations.
Parameters	[-j subject]: event mail subject [-r xmin]: event mail retry period [-d xsec]: event mail delay time [-c content]: event mail content

Command	snmpconfig
Synopsis	snmpconfig set rcvx server port version community severity snmpconfig reset rcvx
Description	Enable or disable the specified SNMP server for SNMP trap notification receiver.
Parameters	set/reset: set or clear receiver rcvx: receiver identifier server : SNMP server address port : SNMP server port number version : SNMP protocol version community : SNMP community name severity : severity level to notify

Command	snmptest
Synopsis	snmptest rcvx
Description	Send a test SNMP trap to the specified server.

4.7.3 Event handling

Command	autowritethrough
Synopsis	autowritethrough [on/off ctl/bbm/pow/fan/ups]
Description	Review or set the auto write-through function.
Parameters	ctl/bbm/pow/fan/ups: controller failure, battery backup module failure, power supply unit failure, fan failure, or UPS failure

Command	autosshutdown
Synopsis	autosshutdown [on/off] [-e upsac/fan/temp] [-t xxmin]
Description	Review or set the auto shutdown function.
Parameters	[on/off]: Enable or disable the auto shutdown function [-e upsac/fan/temp]: event to trigger auto shutdown. (UPS AC power loss and then low battery or UPS connection loss, all fan failure, or over temperature) [-t xxmin]: shutdown delay time

4.8 System Management

4.8.1 Configurations management

Command	configrestore
Synopsis	configrestore [-h]
Description	Erase all configurations on NVRAM or hard disks and restore to factory default.
Parameters	[-h]: erase configurations on all hard disks instead of NVRAM

Command	configerase
Synopsis	configerase hddx hddy ...
Description	Erase controller's configurations stored on hard disks.

Command	configtohdd
Synopsis	configtohdd hddx
Description	Save NVRAM configurations to a hard disk.

Command	configfromhdd
Synopsis	configfromhdd hddx
Description	Restore NVRAM configurations from hard disks.

Command	configget
Synopsis	configget config.bin
Description	Get main configurations stored on NVRAM and save to a file, config.bin.

Command	configset
Synopsis	configset config.bin
Description	Store a file, config.bin, as the controller's main configurations on NVRAM.

Command	configtext
Synopsis	configtext <i>config.txt</i>
Description	Get the main configurations and save to a text file.

Command	configtextmail
Synopsis	configtextmail account
Description	Get the main configurations and save to a text file, which is then sent to the specified mail receiver.

Command	confighdd
Synopsis	confighdd [frequency]
Description	Show or update the progress of background tasks except reconfiguration task.
Parameters	[frequency]: high, medium, or low

4.8.2 Time management

Command	dateset
Synopsis	dateset static/ntp [-t YYYY/MM/DD/hh/mm]/[-n xxx.yyy.zzz]
Description	Set the current date and time on the controller.
Parameters	[-t YYYY/MM/DD/hh/mm]: date and time. This is valid only when static is specified. [-n xxx.yyy.zzz]: NTP server network address. This is valid only when ntp is specified.

Command	timezoneset
Synopsis	timezoneset +/- x
Description	Set the time zone.
Parameters	+/- x : increase or decrease hour (x) starting from GMT

Command	ntpsync
Synopsis	ntpsync
Description	Immediately synchronize controller's time with network time server.

Command	datelist
Synopsis	datelist
Description	List the current date, time, and time zone on the controller.

4.8.3 Administration security control

Command	login
Synopsis	login <i>username</i> [-t <i>target_controller</i>]
Description	Login into CLI with an account and its password.
Parameters	<i>username</i> : enter the user name [-t <i>target_controller</i>]: enter the IP address of the RAID subsystem the users want CLI to log in

Command	passwd
Synopsis	passwd user/admin <i>old_password new_password</i>
Description	Set or change the password for an account.
Parameters	<i>old_password</i> : enter the old password <i>new_password</i> : enter the new password

Command	passwdchk
Synopsis	passwdchk user/admin [on/off]
Description	Review or set password checking for an account. Show or change the setting of password check for an account.
Parameters	[on/off]: enable or disable the password check

Command	paswdmail
Synopsis	passwdmail [-s <i>account</i>]/[send]/[off]
Description	When enabled, the email account to which the password reminder should be sent to is displayed. When disabled, off is displayed. Only one of the three options can be specified at a time.
Parameters	[-s <i>account</i>]: enable and set the mail account [send]: send the mail [off]: disable the function

Command	logout
Synopsis	logout/quit/bye/exit
Description	Log out the current user and return to the user name prompt.

Command	autologout
Synopsis	autologout [x min/off]
Description	Review or set the logout timer.
Parameters	x min: time out value off: turn off the auto logout function

Command	forward
Synopsis	forward [on/off]
Description	Show or change the setting of forwarding control.
Parameters	[on/off]: enable or disable the forwarding

4.8.4 System information

Command	ctlname
Synopsis	ctlname ctlx controller_name
Description	Set the controller name.

Command	sysname
Synopsis	sysname system_name
Description	Set the system name.

Command	ctllist
Synopsis	ctllist ctlx
Description	List the controller-related information.

4.8.5 Miscellaneous

Command	restart
Synopsis	restart [-h] [-b]
Description	Restart or halt the controller.
Parameters	[-h]: halt without restart [-b]: effective for both controllers

Command	beeper
Synopsis	beeper <i>on/off/mute</i>
Description	Review or set the beeper.

Command	fwupdate
Synopsis	fwupdate image.bin [-b]
Description	Upload the firmware image or update the boot code with the file, image.bin.
Parameters	[-b]: update boot code

Command	fwupdateprog
Synopsis	fwupdateprog
Description	List the current firmware update progress.

Command	battery list
Synopsis	battery list <i>ctlx</i>
Description	List the status of the battery installed in a controller.

Command	ctldst
Synopsis	ctldst on/off
Description	Enable or disable the detailed self test of controller during start-up.

Command	diagdump
Synopsis	diagdump diag.bin
Description	Export extensive diagnostics information from the controller to a file.

Command	nandflash
Synopsis	nandflash primary/secondary
Description	Show the current status of the on-board NAND flash chips.

Command	bbmcontrol
Synopsis	bbmcontrol on/off
Description	Enable or disable battery backup support.

4.9 Miscellaneous Utilities

4.9.1 Lookup RAID systems

Command	raidlookup
Synopsis	raidlookup
Description	Search all RAID systems on the local network and list the following information of each RAID system: controller IP address, system model name, system name, firmware version, and beeper alarm status.

4.9.2 Turn on/off CLI script mode

Command	scriptmode
Synopsis	scriptmode [on/off]
Description	Turn on or off the CLI script mode.

4.9.3 Get command list and usage

Command	help
Synopsis	help [<i>class_name/command</i>]
Description	help: list the name of all classes. help <i>class_name</i> : list commands in the specified class. help <i>command</i> : display the full documentation.

4.10 Configuration shortcuts

4.10.1 RAID quick setup

Command	raidquick
Synopsis	raidquick [-r <i>raidlevel</i>] [-i <i>initopt</i>] [-s <i>spare_no</i>]
Description	Initialize RAID configurations and LUN mapping according to the specified.
Parameters	[-r <i>raidlevel</i>]: RAID level [-i <i>initopt</i>]: initialization method [-s <i>spare_no</i>]: the number of global spare disks

4.10.2 Performance profile

Command	perfprofile
Synopsis	perfprofile [avstream/maxiops/maxthruput/off]
Description	Select the performance profile to apply
Parameters	[avstream/maxiops/maxthruput/off]: AV application, maximum IO per second, maximum throughput, or off.

Chapter 5: Troubleshooting

5.1 Problems and Solutions

When operating with the RAID system, users might encounter some problems. Refer to the table below for the most common conditions and solutions.

Table 5-1 Troubleshooting

Condition	Solution
Disk groups cannot be deleted.	Make sure that there is no logical disk in the disk group to be deleted.
Logical disks cannot be deleted.	Make sure that there is no volume on the logical disk to be deleted.
Disk group settings are not allowed to change.	Make sure that no logical disk is initializing. The disk group must not be rebuilding.
Global spare disk cannot be removed.	The global spare disk must not be rebuilding.
HDD state shows unknown. Probable: HDD cannot be recognized by the controller.	Turn off the On-line Array Roaming option. Then re-install all the unknown disks to the system. The HDD state will return to “Unused” state.
HDD state shows conflict. Probable: The cache unit size is bigger than stripe size of any logical disks discovered. Probable: HDD configurations conflict with the configurations in the controller.	Adjust the cache unit size so as to adopt the logical disks. Clear configurations on the conflict HDD (See 2.10.1 Restoring to factory settings). From the RAID Management > Hard Disks , remove the conflict HDD permanently. Then, add it to the system.
Disk group enters degraded mode.	Make sure that there are member disks available. Use the Array Recovery Utility (ARU) to restore the disks to the degraded disk group. (See 2.7.13 Array recovery for detailed information.)

Table 5-1 Troubleshooting

Condition	Solution
Failed hard disk interrupts the reconfiguration tasks.	Unused hard disks are used for rebuilding. When rebuilding is complete, the interrupted reconfiguration tasks are resumed. If there is no unused hard disk on the system, rebuilding will start when the new hard disk is installed.
The RAID system beeps.	Check the beeper alarm reason. Click the Beeper icon from the GUI main page, the failure or error condition is marked.
Faulty logical disks cannot be recovered. Faulty volumes cannot be recovered.	Make sure that faulty disk groups have been restored. Make sure that faulty logical disks have been recovered.
Disk Self Test (DST) is paused or has aborted.	Stop all hard disk access.
Some pages in the System Management menu are not viewable.	Make sure that you are logged in with the admin account.

5.2 Beeper Alarm

When the **Beeper Control** is set to **On** (See **2.9.4 UPS**), the system will emit a beeper alarm if one of the following occurs. If the user mutes the beeper via CLI, LCD, or GUI, the system temporarily mutes the beeper until a new failure or error occurs.

- Voltage failure or error
- Power supply failure or error
- Fan failure or error
- Temperature failure or error
- BBM failure or error (when BBM is connected)
- Disk SMART warning
- Disk BBR error
- DG with degraded LD and no rebuild task
- DG with faulty LD

Appendix A: Understanding RAID

A.1 RAID Overview

The controller supports eleven types of RAID: RAID 0, 1, 3, 5, 6, 10, 30, 50, 60, JBOD and NRAID. The application(s) you are using will determine which RAID setup is best for you.

- **RAID Level 0**

This level offers high transfer rates and is ideal for large blocks of data where speed is of the essence. Computer Aided Design, graphics, scientific computing, image, and multimedia applications are all good examples. If one drive in a RAID 0 array fails, the entire data array is lost.

- **RAID Level 1**

This level may be an appropriate choice if cost and performance are of significantly less importance than fault tolerance and reliability.

- **RAID Level 3**

This level is similar to the more commonly used level 5. Both offer a good level of fault tolerance and overall system reliability at a reasonable cost for redundancy overhead. RAID 3 is useful for large file sequential writes such as video applications.

- **RAID Level 5**

This level offers high I/O transaction rates and is the ideal choice when used with on-line transaction processing applications, such as those used in banks, insurance companies, hospitals, and all manner of office environments. These applications typically perform large numbers of concurrent requests, each of which makes a small number of disk accesses. If one drive in a RAID level 5 array fails, the lost data can be rebuilt from data on the functioning disks.

- **RAID Level 6**

This level is similar to level 5. Data is striped across all member disks and parity is striped across all member disks, but RAID 6 has two-dimensional parities, so it can tolerate double-disk failure.

- **JBOD ("Just a Bunch of Disks")**

This is a method of arranging multiple disks and, technically, is not RAID. Under JBOD, all disks are treated as a single volume and data is “spanned” across them. JBOD provides no fault tolerance or performance improvements over the independent use of its constituent drives.

- **NRAID ("None RAID")**

This level allows you to combine the capacity of all drives and does not suffer from data redundancy.

- **RAID Level 10**

This level offers a compromise between the reliability and tolerance of level 1 and the high transfer rates provided by level 0.

- **RAID Level 30/50/60**

RAID 30/50/60 performs striping over RAID 3/5/6 groups. With multiple independent RAID groups, performance and reliability can be improved. These RAID levels are supported by data striping volumes over logical disks.

A.2 RAID 0

RAID 0 links each drive in the array to form one large drive. Storage capacity is determined by the smallest drive in the array. This capacity is then applied to format all other drives in the array. When using a 40GB, 50GB and a 60GB drive in a RAID 0 array, your system will effectively have a single 120GB drive (40GB x 3).

RAID 0: Striped disk array without fault tolerance

Characteristics

- Storage capacity = (number of disks) x (capacity of the smallest disk)
- A minimum of two disks are required.
- Fault tolerance: No
- RAID 0 implements a striped disk array, the data is broken down into blocks and each block is written to a separate disk drive.
- I/O performance is greatly improved by spreading the I/O load across many channels and drives.
- No parity calculation is required, freeing up system resources.
- Fastest and most efficient array type but offers no fault tolerance.

Recommended use

- Video production and editing
 - Image editing
 - Pre-press applications
 - Any application requiring high bandwidth
-

The following diagram illustrates writing data to a RAID 0 array composed of four HDDs connected to the controller. Data blocks are distributed across all disks in the array.

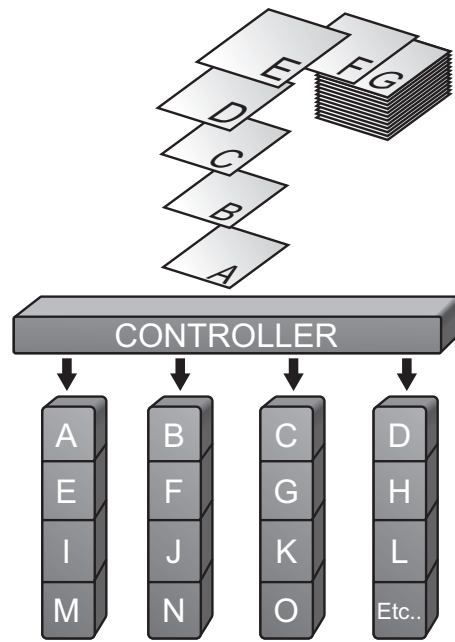


Figure A-1 RAID 0 disk array

A.3 RAID 1

RAID 1 is commonly referred to as *disk mirroring* as all data is duplicated on two or more disks. This provides a high access rate and very high data availability. RAID 1 has low performance for write operations but very high performance for intensive read operations.

RAID 1: Mirroring

Characteristics

- Storage capacity = the capacity of the smallest disk
- A minimum of two disks are required.
- Fault tolerance: Very good
- Read transaction rate: Good. Better than a single drive but worse than many other RAID levels.
- Write transaction rate: Worse than a single drive, but better than many other RAID levels
- 100% data redundancy means that in the event of disk failure, data can be copied directly to the replacement without rebuilding.
- All the disks contain the same data.

Recommended use

- Accounting
 - Payroll
 - Finance
 - Any application requiring high availability
-

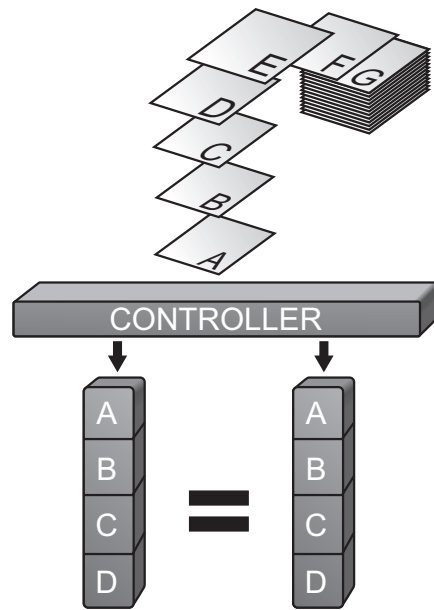


Figure A-2 RAID 1 disk array

A.4 RAID 3

In RAID 3, all data is divided into pieces, after which the system calculates the parity of these pieces. The pieces are written to separate disks in parallel with the writing of the parity data. In the event of disk failure, the parity data can be used to rebuild the lost data. If two or more disks fail, data will be lost. While the low ratio of parity disks to data disks ensures high efficiency, the parity disk is accessed more frequently than other disks, therefore making it unsuitable for random write access.

RAID 3: Parallel transfer with parity

Characteristics

- Storage capacity = (number of disks - 1) x (capacity of the smallest disk)
- A minimum of three disks are required.
- Fault tolerance: Good
- The data block is striped, written on the data disks. Stripe activity is generated on writes, recorded on the parity disk and checked on reads.
- Low ratio of (parity) disks to data disks ensures high efficiency.

Recommended use

- Video production and live streaming
 - Image editing
 - Video editing
 - Any application requiring high throughput
-

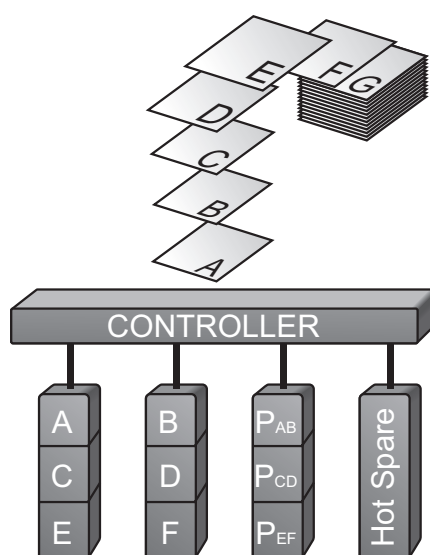


Figure A-3 RAID 3 disk array

A.5 RAID 5

With RAID 5, the system calculates parity from data on three drives. If one of the drives fails, parity data can be used to rebuild the lost data. Under RAID 5, parity data is stored across all disks in the array. This maximizes the amount of storage capacity available from all drives in the array while still providing data redundancy. Data under RAID 5 is block-interleaved.

RAID 5: Independent data disks with distributed parity blocks

Characteristics

- Storage capacity = (number of disks - 1) x (capacity of the smallest disk)
- A minimum of three disks are required.
- Fault tolerance: Good
- Each data block is written to a disk. The parity of blocks with the same rank is generated on writes, recorded in a distributed location and checked on reads.
- Highest read data transfer rate, medium write data transfer rate
- Relatively low ratio of (parity) disks to data disks results in high efficiency.
- Good aggregate transfer rate
- Most versatile RAID level

Recommended use

- File and application servers
- Database servers
- Internet, email and news servers
- Intranet servers

The diagram below represents the writing of data on a RAID 5 array composed of four HDDs connected to the controller. Parity blocks are represented by the letter P.

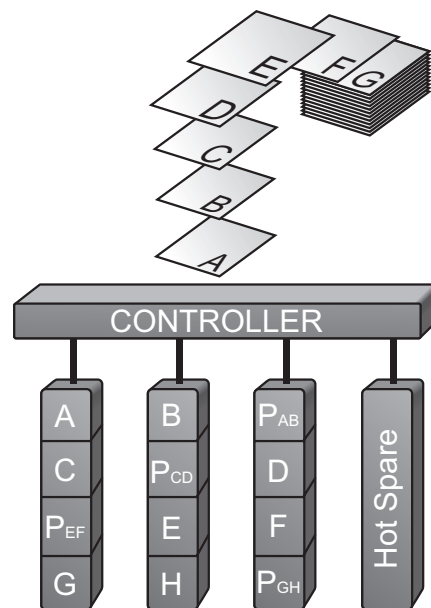


Figure A-4 RAID 5 disk array

A.6 RAID 6

RAID 6 stripes data and parity data across an array of drives, as with RAID 5, and calculates two sets of parity information for each stripe to improve fault tolerance. Performance-wise, RAID 6 is generally slightly worse than RAID 5 in terms of writes, due to the extra parity calculations. It may, however, be slightly faster in terms of random reads, due to the spreading of data over one more disk. As with RAID 3 and RAID 5, performance can be adjusted by changing stripe size.

RAID 6: Independent data disks with double parity blocks

Characteristics

- Storage capacity = (number of disks -2) x (capacity of the smallest disk)
- A minimum of four disks are required.
- Fault tolerance: very good to excellent
- Good speed with random reads

Recommended use

- File and application servers
 - Database servers
 - Internet, email and news servers
 - Intranet servers
 - Use in high reliability server environments
-

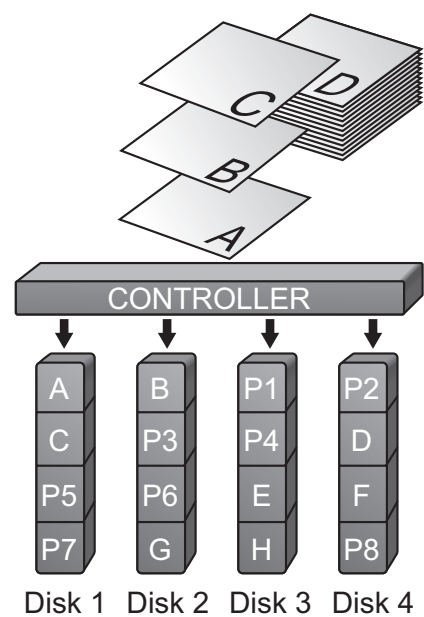


Figure A-5 RAID 6 disk array

A.7 RAID 10

RAID 10 arrays are formed by striping data across RAID 1 sub-arrays. This offers better performance than RAID 1 alone but does not have the speed of a pure RAID 0 array. Storage efficiency and fault tolerance vary depending on the number and size of sub-arrays compared to the array as a whole.

RAID 10: High reliability setup combined with high performance

Characteristics

- Storage capacity = (number of disks/ 2) x (capacity of the smallest disk)
- A minimum of four disks are required.
- Same fault tolerance as RAID 1
- I/O rates are high thanks to striping RAID 1 segments
- Can handle multiple simultaneous disk failures

Recommended use

- High performance database servers

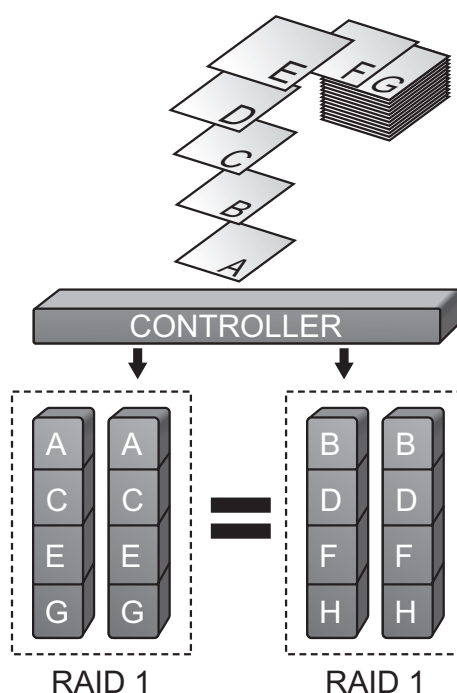


Figure A-6 RAID 10 disk array

A.8 RAID 30

RAID 30 arrays are formed by striping data across RAID 3 sub-arrays. This offers better performance than RAID 3 alone but does not have the speed of a pure RAID 0 array. Storage efficiency and fault tolerance vary depending on the number and size of sub-arrays compared to the array as a whole. RAID 30 resembles RAID 50 in terms of characteristics but is more suitable for handling large files.

RAID 30: Byte striping with parity combined with block striping

Characteristics

- Storage capacity = [(number of disks in each subarray) - 1] x (number of subarrays) x (capacity of the smallest disk)
- A minimum of six disks are required.
- Good fault tolerance, in general
- Increased capacity and performance compared to RAID 3

Recommended use

- Multimedia
 - File servers
 - Large databases
-

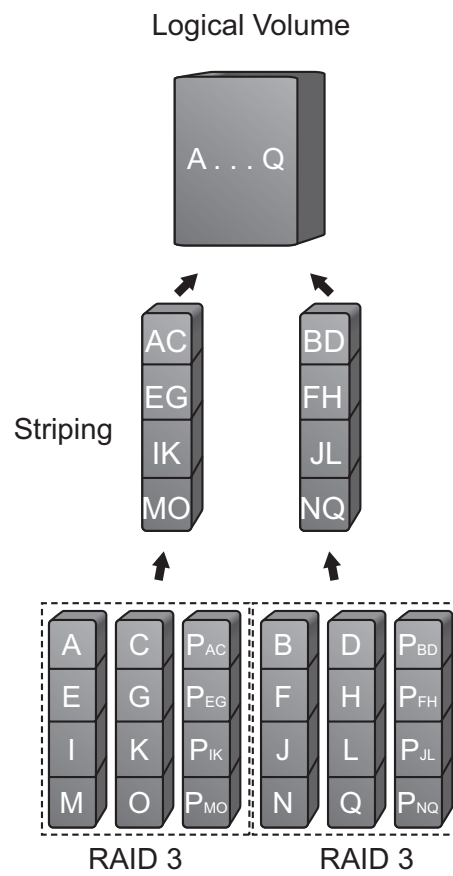


Figure A-7 RAID 30 disk array

A.9 RAID 50

RAID 50 arrays are formed by striping data across RAID 5 sub-arrays. Striping helps increase capacity and performance without adding disks to each RAID 5 array (which will decrease data availability and affect performance when running in a degraded mode). Storage efficiency and fault tolerance vary, depending on the number and size of the sub-arrays compared to the array as a whole. As mentioned above, RAID 50 is similar to RAID 30 in terms of characteristics but is more suitable for use with smaller files.

RAID 50: Block striping with distributed parity combined with block striping

Characteristics

- Storage capacity = [(number of disks in each subarray) - 1] x (number of subarrays) x (capacity of the smallest disk)
- A minimum of six disks are required.
- More fault tolerant than RAID 5
- High data transfer rate
- RAID 0 striping ensures high I/O rates

Recommended use

- Applications requiring random positioning performance
 - Large databases
-

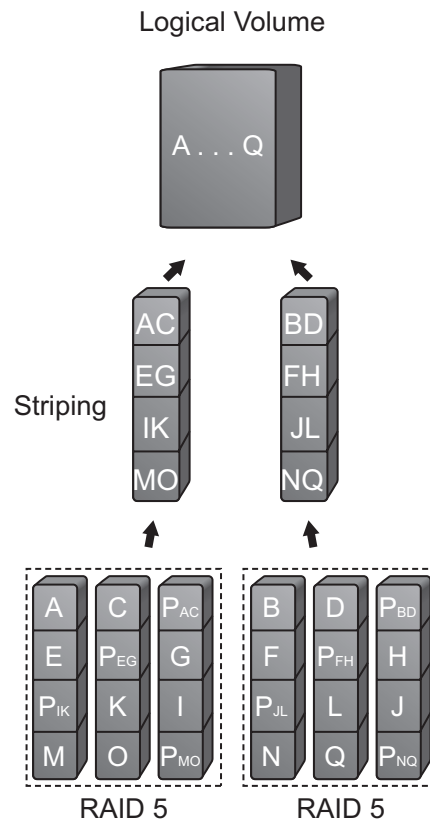


Figure A-8 RAID 50 disk array

A.10 RAID 60

RAID 60 arrays are formed by striping data across RAID 6 sub-arrays. Striping increases the system capacity and performance without adding disks to the array. It features dual parity, which allows for a possible failure of two disks in each array.

RAID 60: Striping with dual parity

Characteristics

- Storage capacity = [(number of disks in each subarray) - 1] x (number of subarrays) x (capacity of the smallest disk)
- A minimum of eight disks are required.
- More fault tolerant than RAID 5
- Dual parity allows two disk failures in each array.
- Increased capacity and performance thanks to striping.

Recommended use

- Data archiving/ backing up
 - High availability applications
 - Large capacity servers
-

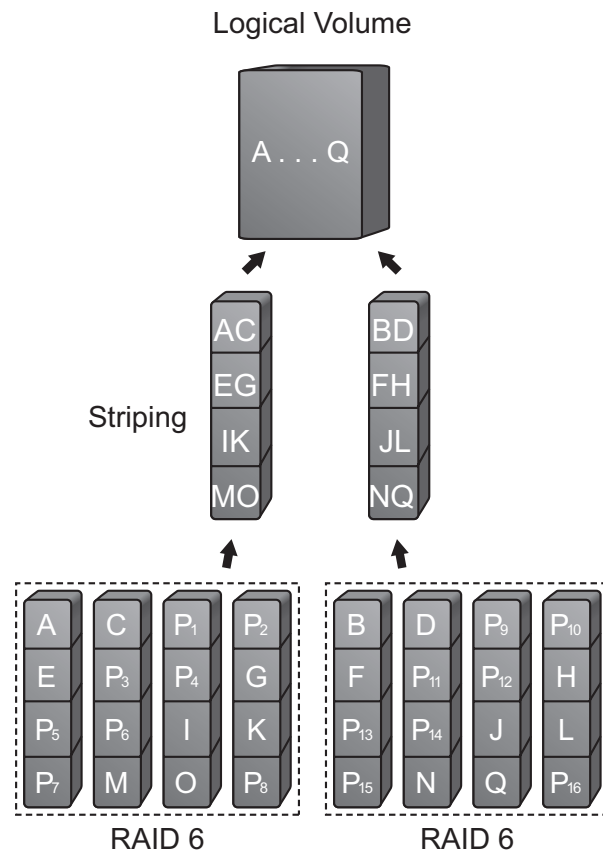


Figure A-9 RAID 60 disk array

A.11 JBOD

JBOD (“Just a Bunch of Disks”) focuses on individual drives. The operating system sees each drive as an individual drive in JBOD mode. Therefore, the total capacity of JBOD is the sum of the capacities of each disk. This allows the user to add disks until the desired total capacity is reached. However, there is no RAID protection in this mode.

JBOD: Spanned disk array without fault tolerance

Characteristics

- Large capacity
- No fault tolerance

Recommended use

- Data backing up
 - Large capacity servers
-

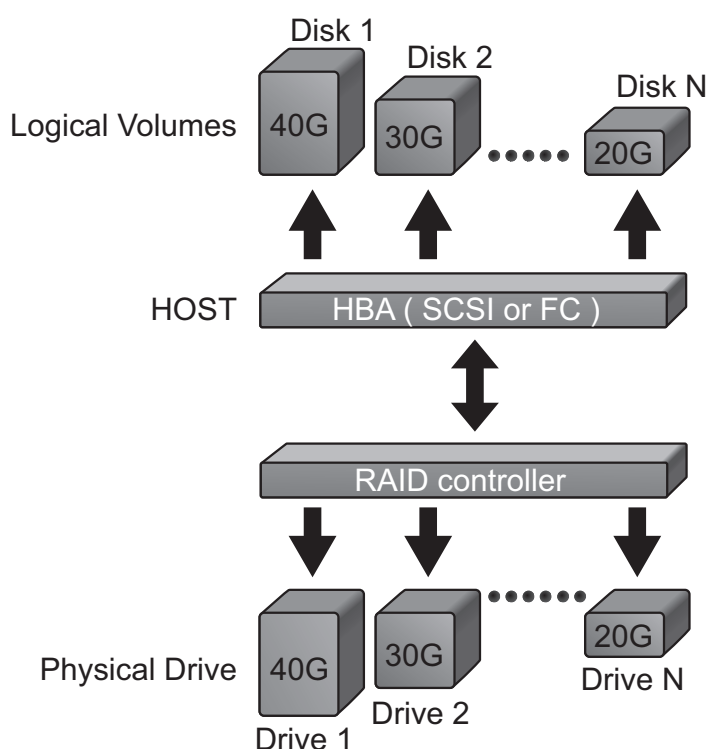


Figure A-10 JBOD disk array

A.12 NRAID

NRAID (“None RAID”) combines all drives as one simple logical volume. The capacity of this volume is the total capacity of the physical member disks. NRAID does not have data redundancy.

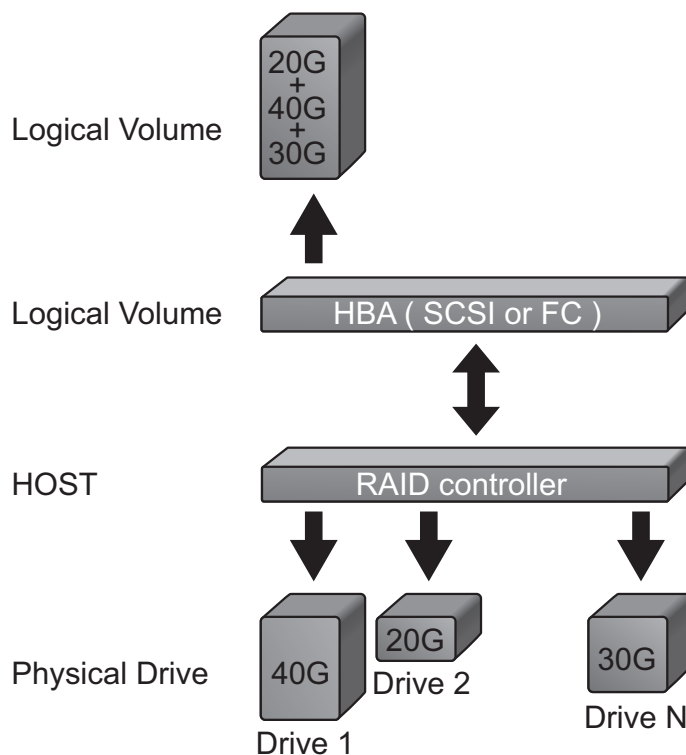


Figure A-11 NRAID

Appendix B: Boot Utility

B.1 Boot Utility Menu

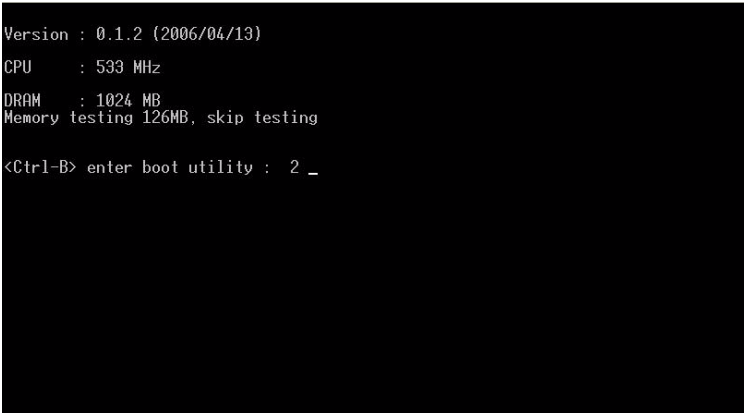
Follow the steps below to enter the Boot Utility menu:

1. Run HyperTerminal (or the terminal program used to establish an RS232 connection with your RAID system) and open the connection established with your RAID system.

**RS232 COM
Port Setting**

Bits per second: 115200
Data bits: 8
Parity: None
Stop bits: 1
Flow Control: None

2. Turn on the RAID system, the terminal shows the version, CPU and memory information.



```
Version : 0.1.2 (2006/04/13)
CPU      : 533 MHz
DRAM     : 1024 MB
Memory testing 126MB, skip testing

<Ctrl-B> enter boot utility : 2 _
```

3. You can press [ESC] to skip the memory test, and press [Ctrl+B] to enter the Boot Utility.

```
*****
*           Boot Utility           *
*****
(N)Set IP address
(L)Load Image by TFTP
(B)Update Boot ROM
(S)Update System ROM
(H)Utility menu
(P)Set Password
(R)Restart system
(Q)Quit & Boot RAID system

Cmd>
```

There are eight items in the Boot Utility menu.

- | | |
|------------------------|-----------------------------|
| (N) Set IP address | (H) Utility menu |
| (L) Load Image by TFTP | (P) Set Password |
| (B) Update Boot ROM | (R) Restart system |
| (S) Update System ROM | (Q) Quit & Boot RAID system |

B.1.1 (N) Set IP address

The Boot Utility allows you to update the Boot ROM and System ROM. First you need to set the controller and server IP addresses. Press [N] to enter the settings.

1. Set the Board IP address and press [Enter].
2. Set the Server IP address and press [Enter].
3. Press [Y] to save the settings.

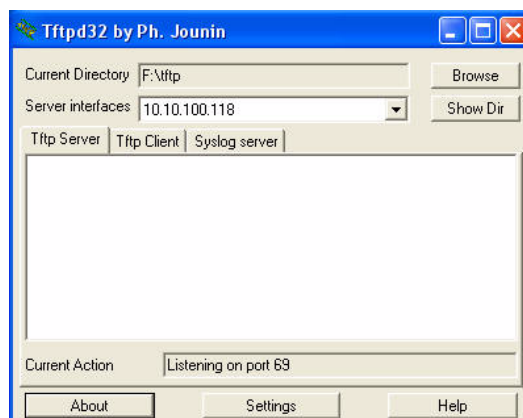
```
*****
*           Boot Utility           *
*****
(N)Set IP address
(L)Load Image by TFTP
(B)Update Boot ROM
(S)Update System ROM
(H)Utility menu
(P)Set Password
(R)Restart system
(Q)Quit & Boot RAID system

Cmd>n
Board IP address : 10.10.88.102
Server IP address : 10.10.100.218
Save setting(Y/N) : y
Cmd>_
```

B.1.2 (L) Load Image by TFTP

Before a Boot ROM or System ROM update, you need to set up the TFTP server for loading a new firmware image. Follow the steps below to load an image:

1. Open the TFTP Server, click the **Browse** button to set the boot code or firmware image directory. You can use the **Show Dir** button to see the files in the directory.



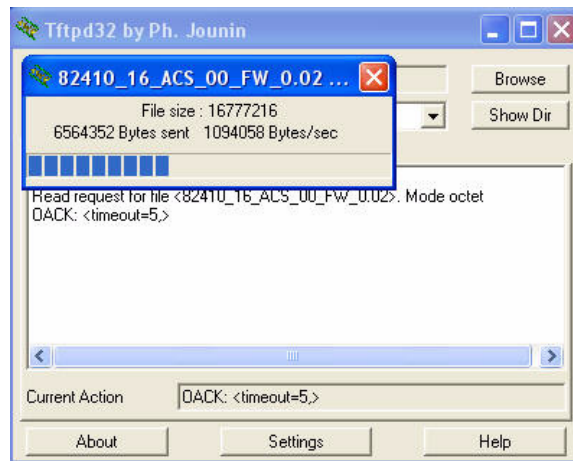
2. Press [L] in the Boot Utility and enter the file name of boot code of firmware.

```
*****
*      Boot Utility      *
*****
(N)Set IP address
(L)Load Image by TFTP
(B)Update Boot ROM
(S)Update System ROM
(H)Utility menu
(P)Set Password
(R)Restart system
(Q)Quit & Boot RAID system

Cmd>L
File name : _
```

Appendix

3. The TFTP server starts loading. When the loading is complete, you can proceed to update the Boot ROM or System ROM.



B.1.3 (B) Update Boot ROM

Press [B] to update the Boot ROM. The firmware versions and the **Update download boot firmware** message are displayed. Press [Y] to start the Boot ROM update. You can see the process percentage on the screen.

```
*****
*      Boot Utility      *
*****
(N)Set IP address
(L)Load Image by TFTP
(B)Update Boot ROM
(S)Update System ROM
(H)Utility menu
(P)Set Password
(R)Restart system
(Q)Quit & Boot RAID system

Cmd>B
Boot version : 0.22
Download version : 0.22
Update download boot firmware(Y/N)Y
Boot ROM update 17%_
```

B.1.4 (S) Update System ROM

Press [S] to update the System ROM. The firmware versions and the **Update New System firmware** message are displayed. Press [Y] and the system starts to update the System ROM with the primary flash and backup flash. You can see the process percentages on the screen.

```
*****
*      Boot Utility      *
*****
(N)Set IP address
(L)Load Image by TFTP
(B)Update Boot ROM
(S)Update System ROM
(H)Utility menu
(P)Set Password
(R)Restart system
(Q)Quit & Boot RAID system

Cmd>S
System version : 0.10.Beta01
Download version : 0.10.Beta01
Update New System firmware(Y/N)y
Primary flash : WRITE 100%
Backup flash : WRITE 3%_
```



Note

Before a Boot ROM or System ROM update, make sure you have loaded the image by TFTP server. If not, the following message displays: **Invalid image size, load firmware first!**

B.1.5 (H) Utility menu

Press [H] to clear the Utility screen, and recall the Boot Utility menu.

B.1.6 (P) Set password

Press [P] to set or change the password for the Boot Utility login.

```
*****
*          Boot Utility          *
*****
(N)Set IP address
(L)Load Image by TFTP
(B)Update Boot ROM
(S)Update System ROM
(H)Utility menu
(P)Set Password
(R)Restart system
(Q)Quit & Boot RAID system

Cmd>p
New Password : ****
Retype new Password : ****_
```

B.1.7 (R) Restart system

Press [R] to exit the Boot Utility and restart the RAID system.

B.1.8 (Q) Quit & Boot RAID system

Press [Q] to exit the Boot Utility, and the system starts to load the primary flash. When the loading is done, you can boot the RAID system.

Appendix C: Event Log Messages

C.1 RAID

- Disk operations

Event ID	0x0800				
Type	RAID	Severity	INFO	Parameters	Disk ID
Message	HDDx added				
Description	hddx was added to the system from the user interface.				
Advice	None				

Event ID	0x0801				
Type	RAID	Severity	INFO	Parameters	Disk ID
Message	HDDx removed				
Description	hddx was removed from the system from the user interface.				
Advice	None				

Event ID	0x0802				
Type	RAID	Severity	INFO	Parameters	Disk ID
Message	HDDx plugged				
Description	hddx was added to the system by manual installation.				
Advice	None				

Event ID	0x0803				
Type	RAID	Severity	INFO	Parameters	Disk ID
Message	HDDx unplugged				
Description	hddx was removed from the system by manual unplugging or hddx failed to respond to the controller.				
Advice	None				

Appendix

- Creation and deletion

Event ID	0x0c00				
Type	RAID	Severity	INFO	Parameters	JBOD ID
Message	JBODx created				
Description	jbdx was created.				
Advice	None				

Event ID	0x0c01				
Type	RAID	Severity	INFO	Parameters	JBOD ID
Message	JBODx deleted				
Description	jbdx was deleted.				
Advice	None				

Event ID	0x1000				
Type	RAID	Severity	INFO	Parameters	DG ID
Message	DGx created				
Description	dgx was created.				
Advice	None				

Event ID	0x1001				
Type	RAID	Severity	INFO	Parameters	DG ID
Message	DGx deleted				
Descripti	dgx was deleted.				
Advice	None				

Event ID	0x1800				
Type	RAID	Severity	INFO	Parameters	DG ID, LD ID
Message	DGxLDy created				
Description	dgxldy was created.				
Advice	None				

Event ID	0x1801				
Type	RAID	Severity	INFO	Parameters	DG ID, LD ID
Message	DGxLDy deleted				
Description	dgxldy was deleted.				
Advice	None				

Event ID	0x1c00				
Type	RAID	Severity	INFO	Parameters	VOL ID
Message	VOLx created				
Description	volx was created.				
Advice	None				

Event ID	0x1c01				
Type	RAID	Severity	INFO	Parameters	VOL ID
Message	VOLx deleted				
Description	volx was deleted.				
Advice	None				

Appendix

- Initialization

Event ID	0x204c				
Type	RAID	Severity	INFO	Parameters	DG ID
Message	Write-zero init on DGx started				
Description	Disk group zeroing task on dgx was started.				
Advice	None				

Event ID	0x204d				
Type	RAID	Severity	INFO	Parameters	DG ID, LD ID
Message	Logical disk init on DGxLDy started				
Description	Logical disk initialization task on dgxldy was started.				
Advice	None				

Event ID	0x204e				
Type	RAID	Severity	NOTICE	Parameters	DG ID
Message	Write-zero init on DGx completed				
Description	Disk group zeroing task on dgx was completed.				
Advice	None				

Event ID	0x204f				
Type	RAID	Severity	NOTICE	Parameters	DG ID, LD ID
Message	Logical disk init on DGxLDy completed				
Description	Logical disk initialization task on dgx was completed.				
Advice	None				

Event ID	0x2050				
Type	RAID	Severity	WARNING	Parameters	DG ID
Message	Write-zero init on DGx aborted				
Description	Disk group zeroing task on dgx was aborted.				
Advice	Check if any disks in the disk group failed, and then re-create the disk group.				

Event ID	0x2051				
Type	RAID	Severity	WARNING	Parameters	DG ID, LD ID
Message	Logical disk init on DGxLDy aborted				
Description	Logical disk initialization task on dgxldy was aborted.				
Advice	Check if any disks in the disk group failed, and then re-create the logical disk.				

Event ID	0x2064				
Type	RAID	Severity	NOTICE	Parameters	Zeroing progress, DG ID, Notify threshold
Message	Write zero progress(y %) on DGx reach to the notify percent(z %)				
Description	The progress of zeroing DG has reached the notify threshold.				
Advice	None				

Event ID	0x2066				
Type	RAID	Severity	NOTICE	Parameters	Init progress, DG ID, LD ID, Notify threshold
Message	Logical disk init progress(w %) on DGxLDy reach the notify percent(z %)				
Description	The progress of initializing logical disk has reached the pre-define threshold.				
Advice	None				

Appendix

- Spare

Event ID	0x0804				
Type	RAID	Severity	INFO	Parameters	Disk ID
Message	Global spare HDDx added				
Description	hddx was selected to be a global spare.				
Advice	None				

Event ID	0x0805				
Type	RAID	Severity	INFO	Parameters	Disk ID
Message	Global spare HDDx removed				
Description	Global spare hddx was changed to be an unused disk.				
Advice	None				

Event ID	0x1002				
Type	RAID	Severity	INFO	Parameters	Disk ID, DG ID
Message	Local spare HDDx of DGy added				
Description	hddx was selected as local spare of dgy.				
Advice	None				

Event ID	0x1003				
Type	RAID	Severity	INFO	Parameters	Disk ID, DG ID
Message	Local spare HDDx of DGy removed				
Description	dgy's local spare, hddx, was removed.				
Advice	None				

- Rebuild

Event ID	0x2000				
Type	RAID	Severity	NOTICE	Parameters	DG ID
Message	Rebuilding on DGx started				
Description	Disk rebuilding on dgx was started.				
Advice	None				

Event ID	0x2001				
Type	RAID	Severity	NOTICE	Parameters	DG ID
Message	Rebuilding on DGx completed				
Description	Disk rebuilding on dgx was completed.				
Advice	None				

Event ID	0x2002				
Type	RAID	Severity	WARNING	Parameters	DG ID
Message	Rebuilding on DGx aborted				
Description	Disk rebuilding on dgx was aborted.				
Advice	None				

Event ID	0x2063				
Type	RAID	Severity	NOTICE	Parameters	Rebuild progress, DG ID, Notify threshold
Message	Rebuild progress(y %) on DG x reach to the notify percent(z %)				
Description	The progress of rebuilding has reached the pre-define threshold.				
Advice	None				

Appendix

- Roaming

Event ID	0x0802				
Type	RAID	Severity	INFO	Parameters	
Message	Disks changed during power-off				
Description	The number of disks installed is different when the controller was powered off. Either existing disks were removed or new disks were installed during power-off.				
Advice	Check hard disk status, and conduct roaming or recovery, if necessary.				

Event ID	0x1004				
Type	RAID	Severity	INFO	Parameters	DG ID
Message	DGx is imported				
Description	Foreign disk group has been imported to be dgx .				
Advice	None				

Event ID	0x1c02				
Type	RAID	Severity	INFO	Parameters	VOL ID
Message	VOLx is imported				
Description	Foreign volume has been imported to be volx .				
Advice	None				

- Recovery

Event ID	0x2052				
Type	RAID	Severity	INFO	Parameters	DG ID
Message	DGx is recovered				
Description	Disk group dgx has been recovered.				
Advice	None				

Event ID	0x2053				
Type	RAID	Severity	INFO	Parameters	DG ID, LD ID
Message	DGxLDy is recovered				
Description	Logical disk dgxldy has been recovered.				
Advice	None				

Event ID	0x2054				
Type	RAID	Severity	INFO	Parameters	VOL ID
Message	VOLx is recovered				
Description	Volume volx has been recovered.				
Advice	None				

C.2 Task

- Disk group expansion

Event ID	0x2009				
Type	TASK	Severity	INFO	Parameters	DG ID
Message	Expansion on DGx started				
Description	Disk group expansion on dgx was started manually.				
Advice	None				

Event ID	0x202d				
Type	TASK	Severity	NOTICE	Parameters	DG ID
Message	Expansion on DGx started by schedule				
Description	Scheduled disk group expansion on dgx was started.				
Advice	None				

Event ID	0x2043				
Type	TASK	Severity	WARNING	Parameters	DG ID
Message	Expansion on DGx failed to start by schedule				
Description	Scheduled disk group expansion on dgx failed to start.				
Advice	Check if the disk group is busy or non-optimal when starting the task.				

Event ID	0x200c				
Type	TASK	Severity	NOTICE	Parameters	DG ID
Message	Expansion on DGx paused				
Description	Disk group expansion on dgx was paused.				
Advice	Check if there is failed member disk in the disk group during the task.				

Event ID	0x200d				
Type	TASK	Severity	NOTICE	Parameters	DG ID
Message	Expansion on DGx resumed				
Description	Disk group expansion on dgx was resumed.				
Advice	None				

Event ID	0x200a				
Type	TASK	Severity	NOTICE	Parameters	DG ID
Message	Expansion on DGx completed				
Description	Disk group expansion on dgx was completed.				
Advice	None				

Event ID	0x205f				
Type	TASK	Severity	NOTICE	Parameters	Expand progress, DG ID, Notify threshold
Message	DG expand progress(y %) on DGx reach to the notify per-				
Description	The progress of dg expanding has reached the pre-define threshold.				
Advice	None				

Appendix

- Logical disk migration

Event ID	0x2004				
Type	TASK	Severity	INFO	Parameters	DG ID, LD ID
Message	Migration on DGxLDy started				
Description	Migration on dgxldy was started manually.				
Advice	None				

Event ID	0x202c				
Type	TASK	Severity	NOTICE	Parameters	DG ID, LD ID
Message	Migration on DGxLDy started by schedule				
Description	Scheduled migration on dgxldy was started.				
Advice	TBD				

Event ID	0x2044				
Type	TASK	Severity	WARNING	Parameters	DG ID, LD ID
Message	Migration on DGxLDy failed to start by schedule				
Description	Scheduled migration on dgxldy failed to start.				
Advice	Check if the logical disk or the disk group is busy or non-optimal when starting the task.				

Event ID	0x2007				
Type	TASK	Severity	NOTICE	Parameters	DG ID, LD ID
Message	Migration on DGxLDy paused				
Description	Migration on dgxldy was paused.				
Advice	Check if the logical disk or the disk group is non-optimal during the task.				

Event ID	0x2008				
Type	TASK	Severity	NOTICE	Parameters	DG ID, LD ID
Message	Migration on DGxLDy resumed				
Description	Migration on dgxldy was resumed.				
Advice	None				

Event ID	0x2006				
Type	TASK	Severity	WARNING	Parameters	DG ID, LD ID
Message	Migration on DGxLDy aborted				
Description	Migration on dgxldy was aborted.				
Advice	Check if the logical disk is faulty.				

Event ID	0x2005				
Type	TASK	Severity	NOTICE	Parameters	DG ID, LD ID
Message	Migration on DGxLDy completed				
Description	Migration on dgxldy was completed.				
Advice	None				

Event ID	0x2061				
Type	TASK	Severity	NOTICE	Parameters	Migrate progress, DG ID, Notify threshold
Message	LD migrate progress(y%) on DGx reach to the notify per-				
Description	The progress of LD migration has reached the pre-define threshold.				
Advice	None				

Event ID	0x206e				
Type	TASK	Severity	NOTICE	Parameters	Migrate progress, DG ID, LD ID, Notify threshold
Message	LD migrate progress(w%) on DGxLDy reach to the notify percent(z%)				
Description	The progress of LD migration has reached the pre-define threshold.				
Advice	None				

- Logical disk capacity expansion

Event ID	0x2037				
Type	TASK	Severity	INFO	Parameters	DG ID, LD ID
Message	Expansion on DGxLDy started				
Description	Logical disk capacity expansion on dgxldy was started manu-				
Advice	None				

Event ID	0x202e				
Type	TASK	Severity	NOTICE	Parameters	DG ID, LD ID
Message	Expansion on DGxLDy started by schedule				
Description	Scheduled logical disk capacity expansion on dgxldy was started.				
Advice	None				

Event ID	0x2045				
Type	TASK	Severity	WARNING	Parameters	DG ID, LD ID
Message	Expansion on DGxLDy failed to start by schedule				
Description	Scheduled logical disk capacity expansion on dgxldy failed to start.				
Advice	Check if the logical disk or the disk group is busy or non-optimal when starting the task.				

Event ID	0x2031				
Type	TASK	Severity	NOTICE	Parameters	DG ID, LD ID
Message	Expansion on DGxLDy paused				
Description	Logical disk capacity expansion on dgxldy was paused.				
Advice	Check if a member disk in the disk group failed during the task.				

Event ID	0x2032				
Type	TASK	Severity	NOTICE	Parameters	DG ID, LD ID
Message	Expansion on DGxLDy resumed				
Description	Logical disk capacity expansion on dgxldy was resumed.				
Advice	None				

Event ID	0x2030				
Type	TASK	Severity	WARNING	Parameters	DG ID, LD ID
Message	Expansion on DGxLDy aborted				
Description	Logical disk capacity expansion on dgxldy was aborted.				
Advice	Check if the disk group is faulty during the task. (TBD)				

Event ID	0x202f				
Type	TASK	Severity	NOTICE	Parameters	DG ID, LD ID
Message	Expansion on DGxLDy completed				
Description	Logical disk capacity expansion on dgxldy is complete.				
Advice	Hosts might need to rescan the LUN of the logical disk to get the updated capacity. The partitions or file systems on the logical disk has to be grown to access the newly created space.				

Event ID	0x2060				
Type	TASK	Severity	NOTICE	Parameters	Expand progress, DG ID, Notify threshold
Message	LD expand progress(y%) on DGx reach to the notify per-				
Description	The progress of LD expanding has reached the pre-define threshold.				
Advice	None				

Appendix

- Logical disk shrink

Event ID	0x200e				
Type	TASK	Severity	NOTICE	Parameters	DG ID, LD ID
Message	DGxLDy shrunk				
Description	DGxLDy shrunk				
Advice	Make sure partitions or file systems on the logical disk have been shrunk before conducting the logical disk capacity shrink. After finishing, hosts might need to rescan the LUN of the logical disk to get the updated capacity.				

- Disk group defragmentation

Event ID	0x2010				
Type	TASK	Severity	INFO	Parameters	DG ID
Message	Defragment on DGx started				
Description	Disk group defragment on dgx was started manually.				
Advice	None				

Event ID	0x2033				
Type	TASK	Severity	NOTICE	Parameters	DG ID
Message	Defragment on DGx started by schedule				
Description	Scheduled disk group defragment on dgx was started.				
Advice	None				

Event ID	0x2047				
Type	TASK	Severity	WARNING	Parameters	DG ID
Message	Defragment on DGx failed to start by schedule				
Description	Scheduled disk group defragment on dgx failed to start.				
Advice	Check if the disk group is busy or non-optimal when starting the task.				

Event ID	0x2013				
Type	TASK	Severity	NOTICE	Parameters	DG ID
Message	Defragment on DGx paused				
Description	Disk group defragment on dgx was paused.				
Advice	Check if there is failed member disk in the disk group during the task.				

Event ID	0x2014				
Type	TASK	Severity	NOTICE	Parameters	DG ID
Message	Defragment on DGx resumed				
Description	Disk group defragment on dgx was resumed.				
Advice	None				

Event ID	0x2011				
Type	TASK	Severity	NOTICE	Parameters	DG ID
Message	Defragment on DGx completed				
Description	Disk group defragment on dgx was completed.				
Advice	None				

Event ID	0x205e				
Type	TASK	Severity	NOTICE	Parameters	Defrag progress, DG ID, Notify threshold
Message	Defrag progress(y%) on DGx reach to the notify per-				
Description	The progress of defragmentation has reached the pre-define threshold.				
Advice	None				

- Volume expansion

Event ID	0x202a				
Type	TASK	Severity	NOTICE	Parameters	VOL ID
Message	VOLx expanded				
Description	Volume capacity expansion on volx was completed.				
Advice	Hosts might need to rescan the LUN of the volume to get the updated capacity, and the partitions or file systems on the volume has to be grown to access the newly created space.				

Appendix

- Disk cloning

Event ID	0x2015				
Type	TASK	Severity	INFO	Parameters	DISK ID, DISK ID
Message	Clone from HDDx to HDDy started				
Description	Disk cloning from hddx to hddy was started manually.				
Advice	None				

Event ID	0x2034				
Type	TASK	Severity	NOTICE	Parameters	DISK ID, DISK ID
Message	Clone from HDDx to HDDy auto started				
Description	Disk cloning from hddx to hddy was started by SMART warning, BBR-over-threshold event, or by schedule.				
Advice	None				

Event ID	0x2048				
Type	TASK	Severity	WARNING	Parameters	DISK ID, DISK ID
Message	Clone from HDDx to HDDy failed to auto start				
Description	Auto disk cloning from hddx to hddy failed to start.				
Advice	Check if the disk failed or the source disk group is non-optimal when starting the task.				

Event ID	0x2018				
Type	TASK	Severity	NOTICE	Parameters	DISK ID, DISK ID
Message	Clone from HDDx to HDDy paused				
Description	Disk cloning from hddx to hddy was paused.				
Advice	Check if the source disk group is busy or non-optimal during the task.				

Event ID	0x2019				
Type	TASK	Severity	NOTICE	Parameters	DISK ID, DISK ID
Message	Clone from HDDx to HDDy resumed				
Description	Disk cloning from hddx to hddy was resumed.				
Advice	None				

Event ID	0x2017				
Type	TASK	Severity	INFO	Parameters	DISK ID, DISK ID
Message	Clone from HDDx to HDDy stopped				
Description	Disk cloning from hddx to hddy was stopped manually.				
Advice	None				

Event ID	0x201a				
Type	TASK	Severity	WARNING	Parameters	DISK ID, DISK ID
Message	Clone from HDDx to HDDy aborted				
Description	Clone from hddx to hddy was aborted.				
Advice	Check if the disk failed or the target disk was rebuilding when the source disk failed.				

Event ID	0x2016				
Type	TASK	Severity	NOTICE	Parameters	DISK ID, DISK ID
Message	Clone from HDDx to HDDy completed				
Descriptio	Disk cloning from hddx to hddy is complete.				
Advice	None				

Event ID	0x2056				
Type	TASK	Severity	NOTICE	Parameters	DISK ID, DISK ID
Message	Clone from HDDx to HDDy auto-resumed				
Descriptio	Disk cloning from hddx to hddy was auto-resumed.				
Advice	None				

Appendix

Event ID	0x206f				
Type	TASK	Severity	NOTICE	Parameters	Clone progress, DISK ID, DISK ID, Notify threshold
Message	Clone progress(w %) from HDD x to HDD y reach to the notify percent(z %)				
Description	The progress of disk cloning has reached the pre-define threshold.				
Advice	None				

- Disk scrubbing of hard disks

Event ID	0x201c				
Type	TASK	Severity	INFO	Parameters	DISK ID
Message	Scrub on HDD x started				
Description	Disk scrubbing on hddx was started manually.				
Advice	None				

Event ID	0x2035				
Type	TASK	Severity	NOTICE	Parameters	DISK ID
Message	Scrub on HDD x started by schedule				
Description	Scheduled disk scrubbing on hddx was started.				
Advice	None				

Event ID	0x204a				
Type	TASK	Severity	WARNING	Parameters	DISK ID
Message	Scrub on HDD x failed to start by schedule				
Description	Scheduled disk scrubbing on hddx failed to start.				
Advice	Check if the disk is off-line or busy.				

Event ID	0x2020				
Type	TASK	Severity	INFO	Parameters	DISK ID, Sector Num
Message	Scrub on HDDx stopped with y bad sectors detected				
Description	Disk scrubbing on hddx was stopped manually, and y bad sectors were detected.				
Advice	If the number of bad sectors grows exceptionally fast or beyond a reasonable number, consider to conduct diagnostics and replace with new disks.				

Event ID	0x2055				
Type	TASK	Severity	WARNING	Parameters	DISK ID, Sector Num
Message	Scrub on HDDx aborted with y bad sectors detected				
Description	Disk scrubbing on hddx was aborted, and y bad sectors were				
Advice	Check if the disk is off-line or busy.				

Event ID	0x2038				
Type	TASK	Severity	NOTICE	Parameters	DISK ID, Sector Num
Message	Scrub on HDDx completed with y bad sectors detected				
Description	Disk scrubbing on hddx was completed, and y bad sectors				
Advice	If the number of bad sectors grows exceptionally fast or beyond a reasonable number, consider conducting diagnostics and replace with new disks.				

Event ID	0x2065				
Type	TASK	Severity	NOTICE	Parameters	Scrub. Progress, DISK ID, Notify thresh- old
Message	Scrub progress(y %) on HDDx reach to the notify percent(z %)				
Description	The progress of scrubbing disk has reached the pre-define threshold.				
Advice	None				

Appendix

- Disk scrubbing of disk groups

Event ID	0x201d				
Type	TASK	Severity	INFO	Parameters	DG ID
Message	Scrub on DGx started				
Description	Disk scrubbing on dgx was started manually.				
Advice	None				

Event ID	0x2036				
Type	TASK	Severity	NOTICE	Parameters	DG ID
Message	Scrub on DGx started by schedule				
Description	Scheduled disk scrubbing on dgx was started.				
Advice	None				

Event ID	0x2049				
Type	TASK	Severity	WARNING	Parameters	DG ID
Message	Scrub on DGx failed to start by schedule				
Description	Scheduled disk scrubbing on dgx failed to start.				
Advice	Check if the disk group is busy or non-optimal.				

Event ID	0x2021				
Type	TASK	Severity	INFO	Parameters	DG ID, Sector Num, Row Num, Row Num
Message	Scrub on DGw stopped with x bad sectors detected, y inconsistent rows found, and z rows recovered				
Description	Disk scrubbing on dgw was stopped manually, and there were x bad sectors detected, y inconsistent rows found, and z rows recovered.				
Advice	If the number of bad sectors or inconsistent rows grows exceptionally fast or beyond a reasonable number, consider to conduct diagnostics and replace with new disks.				

Event ID	0x2023				
Type	TASK	Severity	NOTICE	Parameters	DG ID, Sector Num, Row Num, Row Num
Message	Scrub on DGw aborted with x bad sectors detected, y inconsistent rows found, and z rows recovered				
Description	Disk scrubbing on dgw was aborted, and there were x bad sectors detected, y inconsistent rows found, and z rows recovered.				
Advice	Check if the disk group is busy or non-optimal.				

Event ID	0x2039				
Type	TASK	Severity	NOTICE	Parameters	DISK ID, Sector Num, Row Num, Row Num
Message	Scrub on DGw completed with x bad sectors detected, y inconsistent rows found, and z rows recovered				
Description	Disk scrubbing on dgw was completed, and there were x bad sectors detected, y inconsistent rows found, and z rows recovered.				
Advice	If the number of bad sectors grows exceptionally fast or beyond a reasonable number, consider to conduct diagnostics and replace with new disks.				

Event ID	0x205d				
Type	TASK	Severity	NOTICE	Parameters	Scrub. Progress, DG ID, Notify threshold
Message	Scrub progress(y %) on DGx reach to the notify percent(z %)				
Description	The progress of scrubbing on dgx has reached the pre-define threshold.				
Advice	None				

Note:

Because one disk group can have only one logical disk executing disk scrubbing, the events do not record ID of the logical disk to execute disk scrubbing.

Appendix

- Disk scrubbing of logic disks

Event ID	0x2040				
Type	TASK	Severity	INFO	Parameters	DG ID, LD_ID
Message	Scrub on DGxLDy started				
Description	Disk scrubbing on dgxldy was started manually.				
Advice	None				

Event ID	0x204b				
Type	TASK	Severity	NOTICE	Parameters	DG ID,
Message	Scrub on DGxLDy started by schedule				
Description	Scheduled disk scrubbing on dgx was started.				
Advice	None				

Event ID	0x2057				
Type	TASK	Severity	WARNING	Parameters	DG ID, LD_ID
Message	Scrub on DGxLDy failed to start by schedule				
Descriptio	Scheduled disk scrubbing on dgxldy failed to start.				
Advice	Check if the logic disk is busy or non-optimal.				

Event ID	0x2041				
Type	TASK	Severity	INFO	Parameters	DG ID, LD_ID, Sector Num, Row Num, Row Num
Message	Scrub on DGvLDw stopped with x bad sectors detected, y inconsistent rows found, and z rows recovered				
Description	Disk scrubbing on dgvldw was stopped manually, and there were x bad sectors detected, y inconsistent rows found, and z rows recovered.				
Advice	If the number of bad sectors or inconsistent rows grows exceptionally fast or beyond a reasonable number, consider to conduct diagnostics and replace with new disks.				

Event ID	0x2042				
Type	TASK	Severity	NOTICE	Parameters	DG ID, LD_ID, Sector Num, Row Num, Row Num
Message	Scrub on DGvLDw aborted with x bad sectors detected, y inconsistent rows found, and z rows recovered				
Description	Disk scrubbing on dgvlw was aborted, and there were x bad sectors detected, y inconsistent rows found, and z rows recovered.				
Advice	Check if the logical disk is busy or non-optimal.				

Event ID	0x203a				
Type	TASK	Severity	NOTICE	Parameters	DG ID, LD_ID, Sector Num, Row Num, Row Num
Message	Scrub on DGvLDw completed with x bad sectors detected, y inconsistent rows found, and z rows recovered				
Description	Disk scrubbing on dgvlw was completed, and there were x bad sectors detected, y inconsistent rows found, and z rows recovered.				
Advice	If the number of bad sectors grows exceptionally fast or beyond a reasonable number, consider to conduct diagnostics and replace with new disks.				

Event ID	0x206d				
Type	TASK	Severity	NOTICE	Parameters	Scrub. Progress, DG ID, LD_ID, Notify threshold
Message	Scrub progress(w %) on DGxLDy reach to the notify percent(z %)				
Description	The progress of scrubbing on dgxldy has reached the pre-define threshold.				
Advice	None				

Appendix

- Disk group parity regeneration

Event ID	0x2024				
Type	TASK	Severity	INFO	Parameters	DG ID
Message	Reg. parity on DGx started				
Description	Reg. parity on dgx was started manually.				
Advice	None				

Event ID	0x2026				
Type	TASK	Severity	WARNING	Parameters	DG ID
Message	Reg. parity on DGx aborted				
Description	Reg. parity on dgx was aborted.				
Advice	Check if the disk group is busy or non-optimal.				

Event ID	0x2027				
Type	TASK	Severity	INFO	Parameters	DG ID
Message	Reg. parity on DGx stopped				
Description	Reg. parity on dgx was stopped manually.				
Advice	None				

Event ID	0x2025				
Type	TASK	Severity	NOTICE	Parameters	DG ID
Message	Reg. parity on DGx completed				
Description	Reg. parity on dgx was completed.				
Advice	None				

Event ID	0x205c				
Type	TASK	Severity	NOTICE	Parameters	Reg. Progress, DG ID, Notify threshold
Message	Reg. progress(y %) on DGx reach to the notify percent(z %)				
Description	The progress of Reg. parity on dgx has reached the pre-define threshold.				
Advice	None				

- Logic disk parity regeneration

Event ID	0x203c				
Type	TASK	Severity	INFO	Parameters	DG ID,
Message	Reg. parity on DGxLDy started				
Description	Reg. parity on dgxldy was started manually.				
Advice	None				

Event ID	0x203e				
Type	TASK	Severity	WARNING	Parameters	DG ID,
Message	Reg. parity on DGxLDy aborted				
Description	Reg. parity on dgxldy was aborted.				
Advice	Check if the logic disk is busy or non-optimal.				

Event ID	0x203f				
Type	TASK	Severity	INFO	Parameters	DG ID,
Message	Reg. parity on DGxLDy stopped				
Description	Reg. parity on dgxldy was stopped manually.				
Advice	None				

Event ID	0x203d				
Type	TASK	Severity	NOTICE	Parameters	DG ID,
Message	Reg. parity on DGxLDy completed				
Description	Reg. parity on dgxldy was completed.				
Advice	None				

Event ID	0x206d				
Type	TASK	Severity	NOTICE	Parameters	Reg. Progress, DG ID, LD_ID, Notify threshold
Message	Reg. progress(w%) on DGxLDy reach to the notify percent(z%)				
Description	The progress of Reg. parity on dgxldy has reached the pre-define threshold.				
Advice	None				

C.3 Disk

- Disk status

Event ID	0x0811				
Type	DISK	Severity	INFO	Parameters	Disk ID
Message	HDDx powered on/off				
Description	hddx was powered on or off.				
Advice	None				

Event ID	0x0817				
Type	DISK	Severity	ERROR	Parameters	Disk ID
Message	HDDx failed				
Description	hddx failed to respond to the controller.				
Advice	Check if the disk is corrupt or the disk interface connection is unstable.				

Event ID	0x0810				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	HDDx issued SMART warning				
Description	Controller detects that hddx is signaling SMART warning.				
Advice	The disk is failing or will fail in the near term, replace the hard				

- Disk IO exception handling

Event ID	0x0818				
Type	DISK	Severity	NOTICE	Parameters	Disk ID
Message	CRC error on HDDx				
Description	The controller detected a CRC error when transferring data with hddx. This could be a transient error due to unstable channel, electronic interference, heavy traffic, or malfunctioning hard disks. The controller will invalidate the data and retry the command.				
Advice	If this event occurs often, check the disk connectivity, check power supply to disks, or replace with a new disk.				

Event ID	0x0819				
Type	DISK	Severity	NOTICE	Parameters	Disk ID
Message	Task abort on HDDx				
Description	The controller aborted the command that hddx failed to respond to controller in time. This could be a transient error due to unstable channel, heavy traffic, or malfunctioning hard disks. The controller will retry the command to complete the IO; however, this could result in performance drop of the disk.				
Advice	If this event occurs often, check the disk connectivity, check power supply to disks, or replace with a new disk.				

Event ID	0x081a				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	Reset on HDDx				
Description	The controller resets hddx that failed to respond to controller in time and forced the disk back to its initial state. This could be a transient error due to unstable channel, heavy traffic, or malfunctioning hard disks. The controller will resume normal access to the disk after resetting the disk; however, this could result in performance drop of the disk. If the disk cannot				
Advice	If this event occurs often, check the disk connectivity, check power supply to disks, or replace with a new disk.				

Event ID	0x081e				
Type	DISK	Severity	NOTICE	Parameters	DISK ID, opcode, sense key, ASC, ASCQ
Message	Check condition on HDDv: SCSI opcode=w, Sense Key=x, ASC=y, ASCQ=z				
Description	This presents the SCSI status number when error happens such as CRC error and it will have some field (Sense Key, ASC, ASCQ).				
Advice	If this event occurs often, check the disk connectivity, check power supply to disks, or replace with a new disk.				

Appendix

- Disk port and chip

Event ID	0x081b				
Type	DISK	Severity	ERROR	Parameters	Disk port ID
Message	Reset disk port x				
Description	The controller resets disk port x that failed to execute commands properly. This could be a transient error due to unstable channel, heavy traffic, or malfunctioning hard disks. The controller will resume normal operations after reset; however, this could result in performance drop of the disks attached to the disk port.				
Advice	If this event occurs often, check the disk connectivity, check power supply to disks, or replace with a new disk.				

Event ID	0x081c				
Type	DISK	Severity	WARNING	Parameters	Chip ID
Message	Reset disk i/f chip x				
Description	The controller resets chip x that failed to execute commands properly. This could be a transient error due to unstable channel, heavy traffic, or malfunctioning hard disks. The controller will resume normal operations of the chip after reset; however, this could result in performance drop of the disks attached to the disk ports of this chip.				
Advice	If this event occurs often, check the disk connectivity, check power supply to disks, or replace with a new disk.				

Event ID	0x081d				
Type	DISK	Severity	FATAL	Parameters	Chip ID
Message	Disk i/f chip x failed				
Description	The controller cannot execute commands properly on chip x after all appropriate recovery procedures were conducted. This could be the result of unstable power supply to the system. All disks controlled by the chip will fail.				
Advice	Check power supply, replace with a new controller, or contact local sales or support office.				

Event ID	0x081f				
Type	DISK	Severity	ERROR	Parameters	Disk Channel ID, Error Code
Message	Disk channel x PCI Error: y				
Description	The controller has detected error in the disk channel.				
Advice	Check if the power supply is stable. Contact local sales or support office.				

- SMART disk self tests

Event ID	0x0807				
Type	DISK	Severity	INFO	Parameters	Disk ID
Message	SHT DST on HDD x started				
Description	hddx started SMART short device self test routine.				
Advice	None				

Event ID	0x0806				
Type	DISK	Severity	INFO	Parameters	Disk ID
Message	EXT DST on HDD x started				
Description	hddx started SMART extended device self test routine.				
Advice	None				

Event ID	0x0808				
Type	DISK	Severity	INFO	Parameters	Disk ID
Message	DST on HDD x stopped				
Description	DST on hddx was stopped by the controller or from the user interface.				
Advice	None				

Event ID	0x0809				
Type	DISK	Severity	NOTICE	Parameters	Disk ID
Message	DST on HDD x completed without error				
Description	DST on hddx completed without error.				
Advice	None				

Appendix

Event ID	0x080a				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	DST on HDDx unable to complete due to fatal error				
Description	DST on hddx unable to complete due to fatal error.				
Advice	The disk failed or will fail soon, replace the hard disk.				

Event ID	0x080b				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	DST on HDDx completed with read error				
Description	DST on hddx completed with read error.				
Advice	The disk failed or will fail soon, replace the hard disk.				

Event ID	0x080c				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	DST on HDDx completed with servo error				
Description	DST on hddx completed with servo error.				
Advice	The disk failed or will fail soon, replace the hard disk.				

Event ID	0x080d				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	DST on HDDx completed with electrical error				
Description	DST on hddx completed with electrical error.				
Advice	The disk failed or will fail soon, replace the hard disk.				

Event ID	0x080e				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	DST on HDDx completed with unknown test element error				
Description	DST on hddx completed with error but the failed elements are unknown.				
Advice	The disk failed or will fail soon, replace the hard disk.				

- Bad block handling

Event ID	0x1401				
Type	DISK	Severity	WARNING	Parameters	Start Sector NO, End Sector NO, Disk ID
Message	Bad blocks between sector x and sector y on HDD z detected				
Description	A bad block starting from sector x on hdd y was detected by the controller.				
Advice	If the number of bad blocks detected is growing exceptionally fast or beyond a reasonable number, consider to conduct diagnostics and replace with new disks. If there is no subsequent event notifying the recovery or reallocation of the bad block detected, data on the bad block is lost.				

Event ID	0x1404				
Type	DISK	Severity	WARNING	Parameters	Start Sector NO, End Sector NO, Disk ID
Message	Bad blocks between sector x and sector y on HDD z recovered				
Description	A bad block starting from sector x on hdd y was recovered by the controller.				
Advice	If the number of bad blocks detected grows exceptionally fast or beyond a reasonable number, consider to conduct diagnostics and replace with new disks.				

Event ID	0x1400				
Type	DISK	Severity	WARNING	Parameters	Sector NO, Sector NO, Disk ID
Message	A BBR entry added for mapping sector x to sector y on HDD z				
Description	An entry of bad block reallocation table at was allocated for mapping sector x to sector y on hdd z .				
Advice	If the number of BBR table entries or spare blocks being reallocated grows exceptionally fast or beyond a reasonable number, consider to conduct diagnostics and replace with new disks.				

Appendix

Event ID	0x1408				
Type	DISK	Severity	WARNING	Parameters	Sector NO, Disk ID
Message	Invalidate sector x on HDD y				
Description	The controller marks an area starting from sector x on hdd y as non-trustable by recording the sector in the bad block real-location table. When the controller accesses the invalidated areas, it returns media error to hosts. This happens when the controller cannot rebuild data from remaining disks (This results in data loss), but the area on disk is still accessible. The mark could be removed when hosts writes to this area or corresponding logical disk is re-created.				
Advice	If the number of BBR table entries being allocated grows exceptionally fast or beyond a reasonable number, consider to conduct diagnostics and replace with new disks.				

Event ID	0x140e				
Type	DISK	Severity	WARNING	Parameters	Sector NO, Disk ID
Message	Read from an invalidated block at sector x on HDD y				
Description	The hosts read data from sector x on hdd y which was previously marked an invalidated area. The hosts got media error from the controller. This happens when the controller cannot rebuild data from remaining disks (This results in data loss), but the area on disk is still accessible.				
Advice	If the number of BBR table entries being allocated grows exceptionally fast or beyond a reasonable number, consider to conduct diagnostics and replace with new disks.				

Event ID	0x1409				
Type	DISK	Severity	NOTICE	Parameters	Threshold value, Disk ID
Message	BBR exceeds notice threshold x% on HDD y				
Description	The number of bad block reallocation table entries on hdd y has exceeded the pre-defined threshold level. The severity of this event depends on the threshold being exceed. Over threshold 1/2/3 leads to notice events.				
Advice	If the number of BBR table entries or spare blocks being reallocated grows exceptionally fast or beyond a reasonable number, consider to conduct diagnostics and replace with new disks.				

Event ID	0x140a				
Type	DISK	Severity	WARNING	Parameters	Threshold value, Disk ID
Message	BBR exceeds alert threshold x% on HDD y				
Description	The number of bad block reallocation table entries on hdd y has exceeded the pre-defined threshold level. The severity of this event depends on the threshold being exceed. Over threshold 4 leads to warning events.				
Advice	If the number of BBR table entries or spare blocks being reallocated grows exceptionally fast or beyond a reasonable number, consider to conduct diagnostics and replace with new disks.				

Event ID	0x140d				
Type	DISK	Severity	NOTICE	Parameters	Disk ID
Message	BBR exceeds clone threshold on HDD x				
Description	The number of bad block reallocation table entries on hdd x has exceeded the pre-defined threshold level to trigger disk cloning.				
Advice	If the number of BBR table entries or spare blocks being reallocated grows exceptionally fast or beyond a reasonable number, consider to conduct diagnostics and replace with new disks.				

Event ID	0x1402				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	Out of BBR table entries on HDDx				
Description	All entries of the bad block reallocation table were occupied, and neither reallocation nor block invalidation could be done if new bad sectors are detected.				
Advice	Replace with new disks to prevent data loss.				

Event ID	0x1403				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	Out of BBR spare blocks on HDDx				
Description	On-disk reserved space for bad block reallocation was occupied, reallocation cannot proceed if new bad sectors are detected.				
Advice	Replace with new disks to prevent from data loss.				

- On-disk metadata

Event ID	0x0814				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	Write primary metadata on HDDx failed				
Description	The controller failed to access the primary RAID metadata stored on hddx and the metadata was non-trustable. However, the secondary RAID metadata still works.				
Advice	Start to monitor more carefully the status of the secondary RAID metadata on this disk.				

Event ID	0x0815				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	Write secondary metadata on HDDx failed				
Description	The controller failed to access the secondary RAID metadata stored on hddx and the metadata was invalid. However, the primary RAID metadata still works.				
Advice	Start to monitor more carefully the status of the primary RAID metadata on this disk.				

Event ID	0x0816				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	Write both metadata on HDDx failed				
Description	The controller failed to access both primary and secondary RAID metadata on hddx, and the RAID metadata was invalid. In this case, hddx will be set to faulty, and disk rebuilding will be started, if needed.				
Advice	None				

Event ID	0x0821				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	Read primary metadata on HDDx failed				
Description	The controller failed to access the primary RAID metadata stored on hddx and the metadata was non-trustable. However, the secondary RAID metadata still works.				
Advice	Start to monitor more carefully the status of the secondary RAID metadata on this disk.				

Event ID	0x0822				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	Read both metadata on HDDx failed				
Description	The controller failed to access both primary and secondary RAID metadata on hddx, and the RAID metadata was non-trustable. In this case, hddx will be set to faulty, and disk rebuilding will be started, if needed.				
Advice	Start to monitor more carefully the status of the primary RAID metadata on this disk.				

Event ID	0x0823				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	Primary metadata checksum error on HDDx failed				
Description	The primary RAID metadata stored on hddx was non-trustable. However, the secondary RAID metadata still works.				
Advice	None				

Appendix

Event ID	0x0824				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	Secondary metadata checksum error on HDDx failed				
Description	The secondary RAID metadata stored on hddx was non-trustable. However, the primary RAID metadata still works.				
Advice	None				

Event ID	0x1405				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	Primary BBR table on HDDx is corrupt				
Description	The controller failed to access the primary BBR table on hddx and the table was invalid. However, the secondary BBR table still works.				
Advice	Start to monitor the status of the secondary BBR table on this disk.				

Event ID	0x1406				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	Secondary BBR table on HDDx is corrupt				
Description	The controller failed to access the secondary BBR table on hddx and the table was non-trustable. However, the primary BBR table still works.				
Advice	Start to monitor more carefully the status of the primary BBR table on this disk.				

Event ID	0x1407				
Type	DISK	Severity	WARNING	Parameters	Disk ID
Message	Both BBR tables on HDDx are corrupt				
Description	The controller failed to access both primary and secondary BBR tables on hddx, and the tables were non-trustable. In this case, the BBR functions cannot work any more.				
Advice	Replace with new disks to prevent from data loss.				

C.4 Host ports

FC

- Hosts

Event ID	0x3000				
Type	HOST	Severity	INFO	Parameters	Host WWPN, Host Port ID
Message	Host x detected on host port y				
Description	The controller detected host x on host port y . The host can start access the controller over the host port.				
Advice	None				

Event ID	0x3001				
Type	HOST	Severity	NOTICE	Parameters	Host WWPN, Host Port ID
Message	Host x removed on host port y				
Description	Host x quitted from host port y .				
Advice	If host quitted unexpectedly, or it happens continuously during host access, check the host connectivity, or contact local sales or support office.				

- Link

Event ID	0x3002				
Type	HOST	Severity	INFO	Parameters	Host Port ID
Message	Host port x link up				
Description	The link on the host port x had been built by the controller successfully, and data transferring can be started.				
Advice	None				

Event ID	0x3003				
Type	HOST	Severity	NOTICE	Parameters	Host Port ID
Message	Host port x link down				
Description	The link on the host port x had been turned down by the controller, and data transferring was posed. This happens when the host port was disconnected from host HBA or switch because of removing/powering down/resetting the host or switch, or removing the cables.				
Advice	If the link unexpectedly disconnects, or it happens continuously during host access, check the host connectivity, or contact local sales or support office.				

- IO exceptions handling

Event ID	0x3004				
Type	HOST	Severity	NOTICE	Parameters	Host Port ID
Message	LIP issued on host port x				
Description	The controller issued LIP (Loop Initialization Packet) on host port x . This is to ask host to rescan the connection and get updated of LUN information, such as capacity change or LUN mapping change.				
Advice	None				

Event ID	0x3005				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	LIP detected on host port x				
Description	The controller detected LIP (Loop Initialization Packet) on host port x . This could be to recover from a transient error due to unstable channel, command time-out, or unexpected host behaviors. The controller will drop the command specified by the host, and the host will retry the command.				
Advice	None				

Event ID	0x3006				
Type	HOST	Severity	WARNING	Parameters	Host Port ID, Host WWPN, LUN ID
Message	Task abort on host port x from host y to LUN z				
Description	The controller received task abort on host port x from host y to LUN z . This could be to recover from a transient error due to unstable channel, command time-out, or unexpected host behaviors. The controller will drop the command specified by the host, and the host will retry the command; however, this could result in LUN performance drop.				
Advice	If this event occurs often, check the host connectivity, check LUN's IO statistics to see if the maximum response time is reasonable for the hosts connected, or contact local sales or support office.				

- Port and chip

Event ID	0x3007				
Type	HOST	Severity	INFO	Parameters	Host Port ID
Message	Host port x started				
Description	The controller has started the host port x successfully, and link-up can be started.				
Advice	None				

Event ID	0x3008				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Port reset detected on host port x				
Description	The controller detected port reset on host port x . This could be to recover from transient error due to a unstable channel, command time-out, or unexpected host behaviors. The controller will drop the command specified by the host, and the host will retry the command; however, this could result in performance drop of the LUNs exported to the host ports of this				
Advice	If this event occurs often, check the host connectivity, check LUN's IO statistics to see if the maximum response time is reasonable for the hosts connected, or contact local sales or support office.				

Appendix

Event ID	0x3009				
Type	HOST	Severity	WARNING	Parameters	Chip ID
Message	Reset host i/f chip x				
Description	The controller resets chip x that failed to execute commands properly. This could be to recover from a transient error due to unstable channel or heavy traffic. The controller will resume normal operations of the chip after reset; however, this could result in performance drop of the LUNs exported to the host ports of this chip.				
Advice	If this event occurs often, check the host connectivity, or contact local sales or support office.				

Event ID	0x300a				
Type	HOST	Severity	FATAL	Parameters	Chip ID
Message	Host i/f chip x failed				
Description	The controller cannot execute commands properly on chip x after all appropriate recovery procedures were conducted. This could be resulted from unstable power supply to the system. All LUNs controlled by the chip will be unavailable to hosts.				
Advice	Check power supply, replace with a new controller, or contact local sales or support office.				

Event ID	0x300b				
Type	HOST	Severity	ERROR	Parameters	Host Channel ID, Error Code
Message	Disk channel x PCI Error: y				
Description	The controller has detected error in the host channel.				
Advice	Check if the power supply is stable. Contact local sales or support office.				

SAS

- Hosts

Event ID	0x300c				
Type	HOST	Severity	INFO	Parameters	Host WWPN, Host Port ID
Message	Host x detected on host port y				
Description	The controller detected host x on host port y . The host can start access the controller over the host port.				
Advice	None				

- Link

Event ID	0x300d				
Type	HOST	Severity	INFO	Parameters	Host Port ID, phy ID
Message	Host port x phy y link up				
Description	The link on the host port x phy y had been built by the controller successfully, and data transferring can be started.				
Advice	None				

Event ID	0x300e				
Type	HOST	Severity	NOTICE	Parameters	Host Port ID, phy ID
Message	Host port x phy y link down				
Description	The link on the host port x phy y had been turned down by the controller, and data transferring was posed. This happens when the host port was disconnected from host HBA or switch because of removing/powering down/resetting the host or switch, or removing the cables.				
Advice	If the link unexpectedly disconnects, or it happens continuously during host access, check the host connectivity, or contact local sales or support office.				

- IO exceptions handling

Event ID	0x300f				
Type	HOST	Severity	WARNING	Parameters	Host Port ID, Host WWPN, LUN ID
Message	Task abort on host port x from host y to LUN z				
Description	The controller received task abort on host port x from host y to LUN z . This could be to recover from a transient error due to unstable channel, command time-out, or unexpected host behaviors. The controller will drop the command specified by the host, and the host will retry the command; however, this could result in LUN performance drop.				
Advice	If this event occurs often, check the host connectivity, check LUN's IO statistics to see if the maximum response time is reasonable for the hosts connected, or contact local sales or support office.				

- Port and chip

Event ID	0x3010				
Type	HOST	Severity	INFO	Parameters	Host Port ID
Message	Host port x started				
Description	The controller has started the host port x successfully, and link-up can be started.				
Advice	None				

Event ID	0x3011				
Type	HOST	Severity	WARNING	Parameters	Chip ID
Message	Reset host i/f chip x				
Description	The controller resets chip x that failed to execute commands properly. This could be to recover from transient error due to a unstable channel or heavy traffic. The controller will resume normal operations of the chip after reset; however, this could result in performance drop of the LUNs exported to the host ports of this chip.				
Advice	If this event occurs often, check the host connectivity, or contact local sales or support office.				

Event ID	0x3012				
Type	HOST	Severity	ERROR	Parameters	Host Channel ID, Error Code
Message	Host channel x PCI Error: y				
Description	The controller has detected error in the host channel.				
Advice	Check if the power supply is stable. Contact local sales or support office.				

Event ID	0x3013				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	IOC Bus Reset on port x				
Description	A bus reset has occurred on port x that was initiated by the IOC.				
Advice	None				

Event ID	0x3014				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Ext Bus Reset on port x				
Description	A bus reset has occurred on port x that was initiated by an external entity.				
Advice	None				

SCSI

- IO exceptions handling

Event ID	0x3015				
Type	HOST	Severity	WARNING	Parameters	Host Port ID, Host SCSI ID, LUN ID
Message	Task abort on host port x from host y to LUN z				
Description	The controller received task abort on host port x from host y to LUN z . This could be to recover from a transient error due to unstable channel, command time-out, or unexpected host behaviors. The controller will drop the command specified by the host, and the host will retry the command; however, this could result in LUN performance drop.				
Advice	If this event occurs often, check the host connectivity, check LUN's IO statistics to see if the maximum response time is reasonable for the hosts connected, or contact local sales or support office.				

Event ID	0x3016				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Host port x detected parity error during Command phase				
Description	Parity error was detected during command phase.				
Advice	None				

Event ID	0x3017				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Host port x detected parity error during Message Out phase				
Description	Parity error was detected during message out phase.				
Advice	None				

Event ID	0x3018				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Host port x detected CRC error while receiving CMD_IU				
Description	CRC error was detected while receiving CMD_IU.				
Advice	None				

Event ID	0x3019				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Host port x detected parity error during Command phase				
Description	Parity error was detected during command phase.				
Advice	None				

Event ID	0x301a				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Host port x detected parity error during Data Out phase				
Description	Parity error was detected during data out phase.				
Advice	None				

Event ID	0x301b				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Host port x detected CRC error during Data Out phase				
Description	CRC error was detected during data out phase.				
Advice	None				

Event ID	0x301c				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Host port x transfer count mismatch				
Description	The amount of data that the target actually transferred does not match the DataLength. The amount of data was specified in the TargetAssist request message.				
Advice	None				

Appendix

Event ID	0x301d				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Host port x data offset error				
Description	Data was received with a data offset that was not expected.				
Advice	None				

Event ID	0x301e				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Host port x too much write data				
Description	More than the expected amount of write data was received from the initiator.				
Advice	None				

Event ID	0x301f				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Host port x IU too short				
Description	A received information unit was shorter than the value allowed by the protocol specification.				
Advice	None				

Event ID	0x3020				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Host port x EEDP Guard Error				
Description	The data in an end-to-end data protection I/O failed the CRC guard check.				
Advice	None				

Event ID	0x3021				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Host port x EEDP Reference Tag Error				
Description	The logical block reference tag in the data protection information block of an end-to-end data protection I/O did not match the expected value.				
Advice	None				

Event ID	0x3022				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Host port x EEDP Application Tag Error				
Description	The logical block application tag in the data protection information block of an end-to-end data protection I/O did not match the expected value.				
Advice	None				

- Port and chip

Event ID	0x3023				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	IOC Bus Reset on port x				
Description	A bus reset has occurred on port x that was initiated by the IOC.				
Advice	None				

Event ID	0x3024				
Type	HOST	Severity	WARNING	Parameters	Host Port ID
Message	Ext Bus Reset on port x				
Description	A bus reset has occurred on port x that was initiated by an external entity.				
Advice	None				

C.5 Controller hardware

- Memory

Event ID	0x241e				
Type	CONTROLLER	Severity	WARNING	Parameters	
Message	Memory ECC single-bit error				
Description	The controller has detected and corrected single-bit error in the memory module.				
Advice	Check if the memory module is installed properly, and make sure the memory module is in the compatibility list. Replace the memory module, and if the error continuously happens, contact local sales or support office.				

- System bus

Event ID	0x2420				
Type	CONTROLLER	Severity	ERROR	Parameters	
Message	System bus parity error				
Description	The controller has detected parity error in the system bus.				
Advice	Check if the power supply is stable. Contact local sales or support office.				

Event ID	0x242c				
Type	CONTROLLER	Severity	ERROR	Parameters	Disk Channel ID, Error Code
Message	Disk channel x PCI Error: y				
Description	The controller has detected error in the disk channel.				
Advice	Check if the power supply is stable. Contact local sales or support office.				

Event ID	0x242d				
Type	CONTROLLER	Severity	ERROR	Parameters	Host Channel ID, Error Code
Message	Disk channel x PCI Error: y				
Description	The controller has detected error in the host channel.				
Advice	Check if the power supply is stable. Contact local sales or support office.				

- Flash chip

Event ID	0x2421				
Type	CONTROLLER	Severity	ERROR	Parameters	
Message	Primary system flash is corrupt				
Description	The primary system flash chip on controller is corrupt and cannot be used. But the secondary flash still works.				
Advice	Check if there are any hardware hazards that lead to abnormal flash corruption. Watch the secondary flash chip.				

Event ID	0x2422				
Type	CONTROLLER	Severity	ERROR	Parameters	
Message	Secondary system flash is corrupt				
Description	The secondary system flash chip on controller is corrupt and cannot be used. But the primary flash still works.				
Advice	Check if there are any hardware hazards that lead to abnormal flash corruption. Watch the secondary flash chip.				

Appendix

Event ID	0x242b				
Type	CONTROLLER	Severity	ERROR	Parameters	
Message	Bootrom corrupt				
Description	Bootrom on controller is corrupt and cannot be used. Because the bootcode is stored on the bootrom, the controller cannot work.				
Advice	Check if the power supply is stable. Replace with a new controller. Contact local sales or support office.				

Event ID	0x2423				
Type	CONTROLLER	Severity	INFO	Parameters	Bad block number
Message	x bad block on primary system flash added				
Description	Bad blocks happened and remapped successfully on the primary system flash.				
Advice	Check if there are any hardware hazards that lead to abnormal flash corruption. Watch the secondary flash chip.				

Event ID	0x2424				
Type	CONTROLLER	Severity	INFO	Parameters	Bad block number
Message	x bad block on secondary system flash added				
Description	Bad blocks happened and remapped successfully on the secondary system flash.				
Advice	Check if there are any hardware hazards that lead to bad blocks. Watch the secondary flash chip.				

Event ID	0x2425				
Type	CONTROLLER	Severity	WARNING	Parameters	
Message	Bad block on primary system flash over 70%				
Description	The amount of bad blocks is over 70% of the table that is used to remap bad blocks.				
Advice	Check if there are any hardware hazards that lead to bad blocks. This flash chip is close to fail.				

Event ID	0x2426				
Type	CONTROLLER	Severity	WARNING	Parameters	
Message	Bad block on secondary system flash over 70%				
Description	The amount of bad blocks is over 70% of the table that is used to remap bad blocks.				
Advice	Check if there are any hardware hazards that lead to bad blocks. This flash chip is close to fail.				

- Controller (In Dual-Controller Configuration)

Event ID	0x242e				
Type	CONTROLLER	Severity	ERROR	Parameters	Controller ID
Message	Controller x failed				
Description	One of the controllers failed, was removed, or powered off, while the other controller remains working. This happens only in dual-controller configuration.				
Advice	Check if the power supply is stable. Replace with a new controller.				

Event ID	0x242f				
Type	CONTROLLER	Severity	ERROR	Parameters	Controller ID
Message	Controller x returned				
Description	One of the controllers failed, was removed, or powered off, while the other controller remains working. This happens only in dual-controller configuration.				

C.6 Enclosure

- Temperature

Event ID	0x2800				
Type	ENCLOSURE	Severity	NOTICE	Parameters	Sensor ID, Enclosure ID, Temperature
Message	Temperature at sensor x in enclosure y back to normal (z c) Temperature at sensor x in controller back to normal (z c)				
Description	The temperature at sensor x in enclosure y or controller returned to normal working temperature range, right now is z °C.				
Advice	If the temperature is very unstable, contact local sales or support office.				

Event ID	0x2801				
Type	ENCLOSURE	Severity	WARNING	Parameters	Sensor ID, Enclosure ID, Temperature
Message	Abnormal temperature detected by sensor x in enclosure y (z c)				
Description	The temperature at sensor x in enclosure y or controller has been out of normal working temperature range, right now is z °C.				
Advice	Check the fans in the system and the air conditioning of the environment.				

Event ID	0x2802				
Type	ENCLOSURE	Severity	ERROR	Parameters	Sensor ID, Enclosure ID
Message	The temperature sensor x in enclosure y failed The temperature sensor x in controller failed				
Description	The controller cannot detect the temperature sensor x in enclosure y or controller.				
Advice	Contact local sales or support office.				

- Fan

Event ID	0x2803				
Type	ENCLOSURE	Severity	INFO	Parameters	Fan ID, Enclosure ID
Message	Fan x in enclosure y detected				
Description	Fan x in enclosure y was installed and present.				
Advice	None				

Event ID	0x2804				
Type	ENCLOSURE	Severity	NOTICE	Parameters	Fan ID, Enclosure ID
Message	Rotation speed of fan x in enclosure y back to normal				
Description	The rotation speed of fan x in enclosure y returned to normal range.				
Advice	If the rotation speed is very unstable, replace the fan, or contact local sales or support office.				

Appendix

Event ID	0x2805				
Type	ENCLOSURE	Severity	WARNING	Parameters	Fan ID, Enclosure ID
Message	Abnormal rotation speed of fan x in enclosure y detected.				
Description	The rotation speed of fan x in enclosure y has been out of normal range.				
Advice	Replace the fan, or contact local sales or support office.				

Event ID	0x2806				
Type	ENCLOSURE	Severity	ERROR	Parameters	Fan ID, Enclosure ID
Message	Fan x in enclosure y failed				
Description	The controller cannot get status from or control fan x in enclosure y , which might have failed or removed.				
Advice	Replace the fan, or contact local sales or support office.				

- Voltage

Event ID	0x2807				
Type	ENCLOSURE	Severity	NOTICE	Parameters	Voltage
Message	+3.3V voltage source in backplane back to normal (z V) +3.3V voltage source in controller back to normal (z V)				
Description	+3.3V voltage source in backplane or controller returned to normal range, right now is zV .				
Advice	If the voltage is very unstable, contact local sales or support office.				

Event ID	0x2808				
Type	ENCLOSURE	Severity	NOTICE	Parameters	Voltage
Message	+5V voltage source in backplane back to normal (z V) +5V voltage source in controller back to normal (z V)				
Description	+5V voltage source in backplane or controller returned to normal range, right now is zV.				
Advice	If the voltage is very unstable, contact local sales or support office.				

Event ID	0x2809				
Type	ENCLOSURE	Severity	NOTICE	Parameters	Voltage
Message	+12V voltage source in backplane back to normal (z V) +12V voltage source in controller back to normal (z V)				
Description	+12V voltage source in backplane or controller returned to normal range, right now is zV.				
Advice	If the voltage is very unstable, contact local sales or support office.				

Event ID	0x280a				
Type	ENCLOSURE	Severity	WARNING	Parameters	Voltage
Message	Abnormal +3.3V voltage source in backplane (z V) Abnormal +3.3V voltage source in controller (z V)				
Description	The current voltage of the +3.3V voltage source in backplane or controller was out of normal range, right now is zV.				
Advice	Check the power supply system, or contact local sales or support office.				

Appendix

Event ID	0x280b				
Type	ENCLOSURE	Severity	WARNING	Parameters	Voltage
Message	Abnormal +5V voltage source in backplane (z V) Abnormal +5V voltage source in controller (z V)				
Description	The current voltage of the +5V voltage source in backplane or controller was out of normal range, right now is zV.				
Advice	Check the power supply system, or contact local sales or support office.				

Event ID	0x280c				
Type	ENCLOSURE	Severity	WARNING	Parameters	Voltage
Message	Abnormal +12V voltage source in backplane (z V) Abnormal +12V voltage source in controller (z V)				
Description	The current voltage of the +12V voltage source in backplane or controller was out of normal range, right now is zV.				
Advice	Check the power supply system, or contact local sales or support office.				

Event ID	0x2821				
Type	ENCLOSURE	Severity	NOTICE	Parameters	Voltage, Enclosure ID
Message	Voltage source x in enclosure y back to normal				
Description	Voltage source x in enclosure y returned to normal range.				
Advice	If the voltage is very unstable, contact local sales or support office.				

Event ID	0x2822				
Type	ENCLOSURE	Severity	WARNING	Parameters	Voltage ID, Enclosure ID, Voltage
Message	Abnormal voltage source x in enclosure y (z V)				
Description	Voltage source x in enclosure y was out of normal range.				
Advice	Check the power supply system, or contact local sales or support office.				

- Power supply

Event ID	0x280d				
Type	ENCLOSURE	Severity	INFO	Parameters	PSU ID, Enclosure ID
Message	Power supply x in enclosure y detected				
Description	Power supply unit (PSU) x was installed and present.				
Advice	None				

Event ID	0x280e				
Type	ENCLOSURE	Severity	ERROR	Parameters	PSU ID, Enclosure ID
Message	Power supply x in enclosure y failed				
Description	The controller cannot get status from power supply unit (PSU) x in enclosure y , which might have failed or removal.				
Advice	Replace the power supply, or contact local sales or support office.				

Appendix

- BBM

Event ID	0x280f				
Type	ENCLOSURE	Severity	INFO	Parameters	
Message	BBM disabled				
Description	The battery backup function was disabled.				
Advice	None				

Event ID	0x2810				
Type	ENCLOSURE	Severity	INFO	Parameters	
Message	Dirty boot and flush data				
Description	The controller was not properly shutdown and it will flush cached data in memory protected by BBM.				
Advice	None				

Event ID	0x2811				
Type	ENCLOSURE	Severity	INFO	Parameters	
Message	Dirty-boot data flush completed				
Description	The data flush was completed, and the controller will restart and return to normal state.				
Advice	None				

Event ID	0x2812				
Type	ENCLOSURE	Severity	INFO	Parameters	
Message	BBM is charging				
Description	BBM was not fully charged, and it started charging.				
Advice	Start host access or operations after the BBM at fully-charged state.				

Event ID	0x2813				
Type	ENCLO-SURE	Severity	NOTICE	Parameters	
Message	BBM charging completed				
Description	BBM charging was done and BBM was fully charged.				
Advice	None				

Event ID	0x2814				
Type	ENCLO-SURE	Severity	WARNING	Parameters	
Message	BBM absent				
Description	The controller cannot detect BBM.				
Advice	Check if the BBM is properly installed or replace with a new BBM.				

Event ID	0x2815				
Type	ENCLO-SURE	Severity	NOTICE	Parameters	
Message	Temperature of BBM back to normal				
Description	The temperature of BBM returned to normal working temperature range.				
Advice	If the temperature is very unstable, contact local sales or support office.				

Event ID	0x2816				
Type	ENCLO-SURE	Severity	WARNING	Parameters	
Message	Abnormal temperature of BBM				
Description	The current temperature of BBM was out of normal range.				
Advice	Check the system fans and the air conditioning.				

Appendix

- UPS

Event ID	0x2817				
Type	ENCLOSURE	Severity	INFO	Parameters	
Message	UPS connection detected				
Description	UPS detected by the controller.				
Advice	None				

Event ID	0x2818				
Type	ENCLOSURE	Severity	WARNING	Parameters	
Message	UPS connection loss				
Description	The controller cannot detect UPS.				
Advice	Make sure that the proper communication cable is securely connected to the UPS.				

Event ID	0x2819				
Type	ENCLOSURE	Severity	WARNING	Parameters	
Message	UPS AC power failure				
Description	The AC line voltage has failed.				
Advice	Make sure it is not unplugged from its power source if utility power exist.				

Event ID	0x281a				
Type	ENCLOSURE	Severity	INFO	Parameters	
Message	UPS AC power back on-line				
Description	The AC line voltage back to normal.				
Advice	None				

Event ID	0x281b				
Type	ENCLOSURE	Severity	WARNING	Parameters	
Message	UPS low battery				
Description	UPS battery charge below normal range.				
Advice	None				

Event ID	0x281c				
Type	ENCLOSURE	Severity	INFO	Parameters	
Message	UPS battery back to normal				
Description	UPS battery charge back to normal range.				
Advice	None				

Event ID	0x281d				
Type	ENCLOSURE	Severity	WARNING	Parameters	
Message	UPS battery will fail				
Description	The UPS has a battery that will fail.				
Advice	Replace the UPS battery as soon as possible.				

Event ID	0x281e				
Type	ENCLOSURE	Severity	INFO	Parameters	
Message	UPS battery replace back to non-failure status				
Description	The UPS is replaced and back to non-failure status.				
Advice	None				

Appendix

Event ID	0x281f				
Type	ENCLOSURE	Severity	WARNING	Parameters	
Message	UPS overload				
Description	The UPS overload.				
Advice	(1) If overload occurs immediately after connecting new equipment to the UPS, the UPS cannot support the new load. You must connect one or more devices to a second UPS, or replace the current UPS with a model that can support a larger load. (2) If the overload was not caused by adding new load equipment, run a UPS self-test to see if the problem clears. If the test fails (an overload still exists), close all open applications at the UPS load equipment and reboot the UPS. If the problem persists, disconnect all equipment from the UPS and reboot the UPS. If the overload still exists, the UPS needs to be repaired or replaced. Contact the UPS vendor support for assistance. If the problem is cleared, reconnect and turn on the load equipment, one piece at a time, to determine which piece of equipment caused the overload.				

Event ID	0x2820				
Type	ENCLOSURE	Severity	INFO	Parameters	
Message	UPS overload solved				
Description	The UPS overload solved.				
Advice	None				

C.7 System

- Configurations

Event ID	0x2400				
Type	SYSTEM	Severity	INFO	Parameters	DISK ID
Message	RAID configurations on HDDx erased				
Description	The RAID configurations stored on hddx were erased. RAID configurations for the disk, such as JBOD disk, disk group, logical disk, and volume, is lost.				
Advice	Re-install the disk to the controller so that the controller can re-initialize it.				

Event ID	0x2401				
Type	SYSTEM	Severity	INFO	Parameters	
Message	RAID configurations on all disks erased				
Description	RAID configurations stored on all disks were erased. All RAID configurations are lost.				
Advice	Restart the controller so that all disks can be re-initialized all together.				

Event ID	0x2415				
Type	SYSTEM	Severity	INFO	Parameters	
Message	NVRAM configurations restore to default				
Description	The controller configurations stored on NVRAM were erased and restored to factory default.				
Advice	None				

Event ID	0x2416				
Type	SYSTEM	Severity	INFO	Parameters	DISK ID
Message	NVRAM configurations restored from HDDx				
Description	The NVRAM configurations were restored from hddx .				
Advice	None				

Appendix

Event ID	0x2417				
Type	SYSTEM	Severity	INFO	Parameters	
Message	NVRAM configurations restored from file				
Description	The configurations were restored from a file uploaded to the controller.				
Advice	None				

Event ID	0x2409				
Type	SYSTEM	Severity	FATAL	Parameters	
Message	NVRAM configuration checksum error				
Description	The checksum stored on NVRAM do not match the contents on NVRAM. This could happen if the controller was not properly shutdown. Because NVRAM configurations might be corrupt and cannot be trusted, all event logs are automatically erased.				
Advice	Restore the configurations from hard disks or by uploading the backed-up configuration file. If this event happens continuously, contact local sales or support office.				

Event ID	0x2431				
Type	SYSTEM	Severity	FATAL	Parameters	
Message	NVRAM mapping table checksum error				
Description	The checksum stored on NVRAM do not match the contents on NVRAM. This could happen if the controller was not properly shutdown. System will restore the default mapping table automatically.				
Advice	Start to monitor more carefully the status of the NVRAM.				

- Security control

Event ID	0x240d				
Type	SYSTEM	Severity	INFO	Parameters	
Message	Admin login				
Description	Administrator login to the controller.				
Advice	None				

Event ID	0x2410				
Type	SYSTEM	Severity	INFO	Parameters	
Message	Admin login failed				
Description	Administrator failed to login to the controller.				
Advice	Check if there is any unauthorized trial access to the controller or there are multiple administrator logins.				

Event ID	0x2427				
Type	SYSTEM	Severity	INFO	Parameters	
Message	User login				
Description	User login to the controller.				
Advice	None				

Event ID	0x2428				
Type	SYSTEM	Severity	INFO	Parameters	
Message	User login failed				
Description	User failed to login to the controller.				
Advice	Check if there is any unauthorized trial access to the controller.				

Event ID	0x240e				
Type	SYSTEM	Severity	INFO	Parameters	
Message	Service login				
Description	Service login to the controller.				
Advice	None				

Appendix

Event ID	0x2411				
Type	SYSTEM	Severity	INFO	Parameters	
Message	Service login failed				
Description	Service failed to login to the controller.				
Advice	Check if there is any unauthorized trial access to the controller.				

Event ID	0x240f				
Type	SYSTEM	Severity	INFO	Parameters	
Message	Accusys login				
Description	Accusys login to the controller.				
Advice	None				

Event ID	0x2412				
Type	SYSTEM	Severity	INFO	Parameters	
Message	Accusys login failed				
Description	Accusys failed to login to the controller.				
Advice	Check if there is any unauthorized trial access to the controller.				

- Events

Event ID	0x0400				
Type	SYSTEM	Severity	FATAL	Parameters	
Message	Event test with severity: fatal				
Description	Users have generated a simulated event to test the event handling/notification mechanisms. The severity level of this event is fatal.				
Advice	None				

Event ID	0x0401				
Type	SYSTEM	Severity	ERROR	Parameters	
Message	Event test with severity: error				
Description	Users have generated a simulated event to test the event handling/notification mechanisms. The severity level of this event is error.				
Advice	None				

Event ID	0x0402				
Type	SYSTEM	Severity	WARNING	Parameters	
Message	Event test with severity: warn				
Description	Users have generated a simulated event to test the event handling/notification mechanisms. The severity level of this event is warn.				
Advice	None				

Event ID	0x0403				
Type	SYSTEM	Severity	NOTICE	Parameters	
Message	Event test with severity: notice				
Description	Users have generated a simulated event to test the event handling/notification mechanisms. The severity level of this event is notice.				
Advice	None				

Appendix

Event ID	0x0404				
Type	SYSTEM	Severity	INFO	Parameters	
Message	Event test with severity: info				
Description	Users have generated a simulated event to test the event handling/notification mechanisms. The severity level of this event is info.				
Advice	None				

Event ID	0x2406				
Type	SYSTEM	Severity	INFO	Parameters	
Message	All event logs erased				
Description	All event logs were erased. After that, this is the first event recorded.				
Advice	None				

Event ID	0x2413				
Type	SYSTEM	Severity	NOTICE	Parameters	
Message	Auto-write-through activated				
Description	The pre-defined triggering events for auto-write-through occurred, and the controller has set the buffer cache as write-through.				
Advice	Check the event logs, and remove the causes of events that trigger auto-write-through.				

Event ID	0x2414				
Type	SYSTEM	Severity	NOTICE	Parameters	
Message	Auto-write-through de-activated				
Description	The pre-defined triggering events for auto-write-through have gone, and the controller restored the original cache setting.				
Advice	None				

Event ID	0x2418				
Type	SYSTEM	Severity	NOTICE	Parameters	
Message	Auto-shutdown activated				
Description	The pre-defined triggering events for auto-shutdown occurred, and the controller was going to shutdown itself.				
Advice	Check the event logs, and remove the causes of events that trigger auto-shutdown. Restart the controller. Disable auto-shutdown first before starting investigating the causes.				

Event ID	0x2419				
Type	SYSTEM	Severity	FATAL	Parameters	
Message	NVRAM event log checksum error				
Description	The checksum stored on NVRAM for event log cannot match the contents on NVRAM. This could happen if the controller was not properly shutdown. Because the event log on NVRAM might be corrupt and cannot be trusted, all event logs will be erased automatically.				
Advice	If this event continuously happens, contact local sales or support office.				

Appendix

- Firmware update

Event ID	0x2407				
Type	SYSTEM	Severity	INFO	Parameters	
Message	System firmware updated				
Description	System firmware was updated successfully.				
Advice	Restart the controller so that the new firmware can be effective.				

Event ID	0x2408				
Type	SYSTEM	Severity	INFO	Parameters	
Message	Failed to update system firmware				
Description	The controller cannot update the system firmware.				
Advice	Check the firmware file is not corrupt and has the correct version.				

Event ID	0x2429				
Type	SYSTEM	Severity	INFO	Parameters	
Message	Boot code updated				
Description	Boot code was updated successfully.				
Advice	Restart the controller so that the new code can be effective.				

Event ID	0x242a				
Type	SYSTEM	Severity	INFO	Parameters	
Message	Failed to update boot code				
Description	The controller cannot update the boot code.				
Advice	Check the firmware file is not corrupt and has the correct version.				

- Email (SMTP) server status

Event ID	0x240b				
Type	SYSTEM	Severity	WARNING	Parameters	
Message	Failed to send mail				
Description	The controller failed to send mail. Both primary and secondary mail servers cannot be reached by the controller.				
Advice	Check if the network connection is up, and check if the network and SMTP settings are correct.				

Event ID	0x240a				
Type	SYSTEM	Severity	NOTICE	Parameters	
Message	Email server back to normal				
Description	The controller can reach the mail server and start to send mail.				
Advice	None				

- System start-up and shutdown

Event ID	0x2402				
Type	SYSTEM	Severity	INFO	Parameters	
Message	System to be restarted or halted				
Description	The RAID system is going to get restarted or halted.				
Advice	None				

Event ID	0x2403				
Type	SYSTEM	Severity	INFO	Parameters	
Message	RAID system started				
Description	The RAID system was started.				
Advice	None				

Appendix

- Miscellaneous

Event ID	0x240c				
Type	SYSTEM	Severity	ERROR	Parameters	Debug Code
Message	System error: x				
Description	Unknown system error, and its event ID is x .				
Advice	Contact local sales or support office.				

Event ID	0x2430				
Type	SYSTEM	Severity	FATAL	Parameters	Debug Code
Message	Fatal system fault: x				
Description	Unknown fatal system fault, and its event ID is x .				
Advice	Contact local sales or support office.				

C.8 Network

- Network

Event ID	0x3400				
Type	NET-	Severity	INFO	Parameters	
Message	Network link up				
Description	The network link had been built successfully.				
Advice	None				

Event ID	0x3401				
Type	NET-	Severity	NOTICE	Parameters	
Message	Network link down				
Description	The network link connection was refused. This happens when the network configuration is incorrect, or cable were removed, or during abnormal network activity.				
Advice	If the network link unexpectedly disconnects, or it happens repeatedly, check the network configuration and hardware. If it is still unable to work, contact local sales or support office.				

Event ID	0x3402				
Type	NET-	Severity	WARNING	Parameters	
Message	MAC address conflicted				
Description	The MAC address of network adapter conflicted with another one on the same network.				
Advice	Try to configure the network adaptor with a different MAC address.				

Event ID	0x3403				
Type	NET-	Severity	WARNING	Parameters	
Message	IP address conflicted				
Description	The IP address of network adapter conflicted with another on the same network.				
Advice	Try to configure the network adaptor with different an IP address.				

Index

A

- accessing the RAID GUI **2-2**
- add LUNs in host **2-29**
- add LUNs in storage group **2-31**
- array recovery **2-42**
 - faulty **2-42**
 - optimal **2-42**
 - partition state transition **2-43**
- array roaming **2-41**
- auto logout
 - setting **2-61**
- auto spare **2-44**
- auto write-through cache **2-56**
- automatic resume **2-38**
- AV streaming **2-13**

B

- background task messages **3-4**
- bad block alert
 - setting **2-47**
- bad block clone
 - setting **2-48**
- beeper alarm **5-2**
- beeper control **2-55**
- bind host/host group and storage group **2-32**
- boot utility **B-1**
 - set IP address **B-2**
 - set password **B-4**
 - update boot ROM **B-3**
 - update system ROM **B-4**

C

- change password **2-60**
- check on read **2-23**
- cloning **2-38**
 - automatic resume **2-38**
- COM port setting **2-50**
- concatenating striping member volumes **1-5**
- concatenating volume units **1-5, 2-37**

- controller
 - factory setting **2-57**

D

- defragmentation
 - defined **1-9**
- delayed write **1-6**
- disk group
 - creating **2-18**
 - defined **1-3**
 - defragmenting **2-34**
 - deleting **2-19**
 - expanding **2-33**
- disk group expansion **1-6**
- disk group, degraded mode **5-1**
- disk self test (DST) **2-40**
 - restrictions **2-40**

E

- emergent info **3-4**
- enclosure polling interval **2-63**
- erase HDD configurations **2-57**
- erase NVRAM configurations **2-57**
- expanding logical disks **2-35, 2-36**
- expanding volumes **2-36**

F

- fast read response **2-23**
- faulty logical disk **5-2**
- faulty volume **5-2**
- FC port
 - connection mode
 - auto, arbitration loop, fabric **2-49**
 - setting **2-49**
- forgotten password **2-9**
- free chunk
 - defined **1-5**

G

- global spare
 - defined **1-4**

GUI refresh rate **2-63**

H

HDD mode, defined **2-15**

HDD state, conflict **5-1**

HDD state, defined **2-15**

HDD state, tray color **2-6**

HDD state, unknown **5-1**

HDD, cloning **2-38**

HDD, code **2-6**

https **1-6**

I

intelligent data computation **2-23**

IO queue, NCQ **2-48**

J

JBOD

creating **2-17**

deleting **2-17**

JBOD, defined **A-12**

spanned disk array without fault

tolerance **A-12**

L

language **2-2**

LCD console

background task messages **3-4**

creating a RAID array **3-6**

emergent info **3-4**

ethernet setting **3-7**

hotkeys **3-5**

status info **3-3**

terminal port setting **3-7**

LCD manipulation procedure **3-1**

LD read algorithm

check on read **2-23**

fast read response **2-23**

intelligent data computation **2-23**

local spare

defined **1-4**

logical disk

creating **2-21**

defined **1-3**

deleting **2-22**

expanding **2-35, 2-36**

shrinking **2-36**

logical disk expansion **1-8**

logical disk shrink **1-9**

logical unit

defined **1-3**

login **2-9**

LUN mapping **1-6**

defined **1-6**

M

maximum IO per second **2-13**

maximum throughput **2-13**

member disk

defined **1-3**

meta-data update frequency **2-46**

migrating **2-34**

limitations **2-35**

mode

config mode **2-12**

monitor mode **2-5**

switch mode **2-5**

multiple system viewer **2-3**

N

NRAID, defined **A-13**

O

on-line array roaming control **2-45**

P

partition state transition **2-43**

password settings **3-8**

performance profile **2-13**

AV streaming **2-13**

maximum IO per second **2-13**

maximum throughput **2-13**

PPP port setting **2-50**

pre-read **1-6**

R

RAID 0, defined **A-3**

striped disk array without fault

tolerance **A-3**

RAID 1, defined **A-4**

- mirroring **A-4**
- RAID 10, defined **A-8**
 - high reliability setup combined with high performance **A-8**
- RAID 3, defined **A-5**
 - parallel transfer with parity **A-5**
- RAID 30, defined **A-9**
 - byte striping with parity combined with block striping **A-9**
- RAID 5, defined **A-6**
 - independent data disks with distributed parity blocks **A-6**
- RAID 50, defined **A-10**
 - block striping with distributed parity combined with block striping **A-10**
- RAID 6, defined **A-7**
 - independent data disks with double parity blocks **A-7**
- RAID 60, defined **A-11**
 - striping with dual parity **A-11**
- RAID system, beep **5-2**
- RAID, quick setup **2-13**
- recovery, procedures **2-43**
- regenerating parity **2-40**
- remove LUNs from host **2-29**
- remove LUNs in storage group **2-32**
- restoring to factory settings **2-57**
- RS232 COM port
 - setting **B-1**

S

- SAS enclosure **2-10**
- scrubbing **2-39**
 - restrictions **2-39**
- send a test mail **2-54**
- setting up the network **2-59**
 - DHCP **2-59**
 - static **2-59**
- setting up the time **2-60**
- shrinking logical disks **2-36**
- shrinking volumes **2-37**
- SMART polling **2-47**
- SMTP **2-51**
 - setting **2-51**
 - test SMTP server **2-60**
- SNMP
 - send a test SNMP trap **2-53**

- setting **2-52**
- SNMP traps, defined **2-52**
- spare restore **2-45**
- SSL **1-6**
- SSL forced
 - setting **2-61**
- status info **3-3**
- storage provisioning **2-26**
 - selective storage
 - add hosts **2-30**
 - add LUNs in storage group **2-31**
 - bind host/host group and storage group **2-32**
 - remove hosts **2-31**
 - remove LUNs in storage group **2-32**
 - unbind hosts/ host groups and storage groups **2-32**
 - simple storage
 - add LUNs in a storage port **2-26**
 - remove LUNs in storage port **2-27**
 - symmetric storage
 - add hosts **2-28**
 - add LUNs in host **2-29**
 - remove hosts **2-28**
 - remove LUNs from host **2-29**

T

- tagged queuing **1-6**
- test SMTP server **2-60**

U

- unbind hosts/ host groups and storage groups **2-32**
- update boot code **2-62**
- update firmware **2-62**
- UPS
 - setting **2-54**

V

- volume
 - concatenated striping **1-5**
 - concatenating **1-5, 2-37**
 - creating **2-24**
 - restrictions **2-24**
 - defined **1-5**

Index

- deleting **2-25**
- expanding
 - restrictions **2-36**
- shrinking **2-37**
 - restrictions **2-37**
- striping **1-5**

W

- write completion
 - write-behind **2-27, 2-29, 2-32**
 - write-through **2-27, 2-29, 2-32**
- write log control **2-45**